American Machinist

Volume 55 NEW YORK, DECEMBER 29, 1921 Number 26

Employment of War-Blinded in German Industries

Methods Used to Enable the Blind Ex-Soldiers to Live Independent of Charity —Machine Operation in Manufacturing Plants

By HUBERT HERMANNS

THE problem of employment for the blind is one which has existed for many years in all the civilized countries of the world, but up to recent years the solution has been left mainly to the State and private institutions. The recent war has, however, given the matter a national aspect, since so many soldiers had the misfortune to lose their eyesight in a national cause. Their number in Germany amounts at the present time to 3,122, as compared with about 34,000 blind in civil life. To occupy the blind ex-soldiers in such a manner that their hard lot is eased as far as possible and that they need not consider themselves an encumbrance or feel themselves humbled by receiving charity, is the honorable duty of every nation.

All the experiences which have been or may be gained in the various countries in regard to the care of the blind should be made available to the whole world. To this end the following article has been written concerning the experiences gained at the Siemens-Schuckert Works of Siemensstadt, near Berlin, where the blind are employed at machines in mass production.

In Germany the law prescribes that large undertakings must employ up to 10 per cent invalids from the war as workmen or officials at their works or offices. Naturally it is most difficult to find suitable employment for the blind in industrial works without charging the undertaking with an economical burden, as the blind must be treated quite differently than the other workmen. By the untiring efforts of Mr. Perls (one of the directors) the Siemens-Schuckert Works have succeeded in employing a considerable number of the war-blinded on useful work which enables almost all of them to make a good living. Experience has shown that there are many operations in mass production on which the blind can be employed.

FIG. 1. A BLIND OPERATOR ON A BENCH DRILL

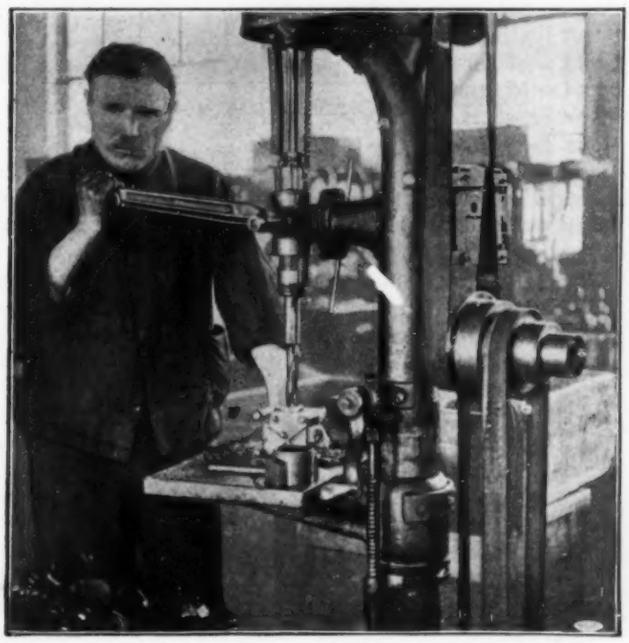


FIG. 3. BOTH HANDS ENGAGED PREVENT INJURY

Especially suitable are operations which are carried out by machinery. In every case it is, as a matter of course, necessary that the moving parts of the machine be carefully covered so that injury to the blind is impossible. The blind man must have the absolute assurance that he is not liable to injury while at work. As the nervous system of the blind and of the war-blinded in particular is very sensitive careful consideration must be given to this point.

How completely successful the efforts in this direction have been, will be proved by the fact that although the Siemens-Schuckert Co. has already trained more than 150 blind to be skilled machine operators, not a

single accident has happened to them up to now. The importance of this fact will be evident when it is known that in Germany the labor associations, which are the guardians of the official prevention of accidents, have a far-reaching veto against the employment of workmen in unsuitable and dangerous work places. Now that the officials of the labor associations have become convinced that the danger of accidents to the blind is not only not greater but actually less than for other workmen employed at machines, the associations have undertaken the full risk against accidents.

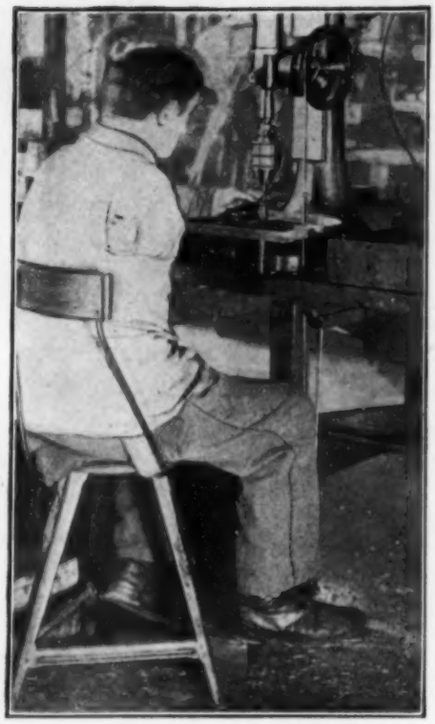


FIG. 2. OPERATING A DRILL WITH THE FOOT

Out of the great number of different branches of work in which at the present time the blind are employed at the Siemens-Schuckert Works, this report will only extend to the employment of the blind at drilling machines. Drilling work has proved particularly suitable for the employment of the blind. Irrespective of the fact that the machines must be carefully safeguarded, provisions must also be made that faulty work and resulting economical losses for the undertaking are prevented as far as possible.

Fig. 1 shows the drilling of holes in cylindrical bodies by means of a table drilling machine. The piece is clamped into a suitable chuck and then the lever with the drill is pulled down to a stop. During the operation, the workman keeps his right hand on the drill lever and the left hand upon the crank of the chuck, which minimizes the danger of accident from the drill.

The machine is driven by a small built-in motor, as the individual motor drive has proved itself by far the best for machines served by the blind, owing to the absence of line shafts and driving belts.

Fig. 2 illustrates the operation of a table-drilling machine by a one-armed blind man. This man, having lost his right arm by a shell explosion, uses the left hand for the insertion of the piece of work, while he operates the lever with the right foot by the aid of a cable. In such drilling work the wishes of the blind with regard to seating accommodation should be considered. As will be seen from the illustration, a simple three-legged stool with a rounded back-rest is provided for this purpose.

Fig. 3 illustrates the operation of a pillar drilling machine by a blind man. The piece to be drilled is inserted in a jig which is held against a stop by the left hand, while the right hand is used to pull the lever down. The moving parts are thus out of reach of the blind.

The simultaneous operation of two semi-automatic drilling machines by one blind man has also proved quite successful, as shown in Fig. 4. The pieces to be drilled are held in a jig which is fastened to the machine table. The jig must be so constructed that the insertion of the piece of work can easily and quickly be effected.

In all drilling operations performed by the blind the drill jig plays a very important part. On multiple-spindle drilling machines with which a number of holes are to be drilled in a piece of work, a special jig guide is provided on the drilling table. As shown in Fig. 5, the drill jig is located by the apertures in the guide, so that the drill always strikes the hole correctly.

In Fig. 6 is shown the operation of a multiple-spindle semi-automatic drilling machine which performs two operations. Special care must here be taken that the blind does not injure himself by coming in contact with the projecting corners of the machine. A thick wrapping of textile fabrics renders excellent service in this direction.

In conclusion some brief general remarks about the employment of the blind in mechanical industries in Germany will be added.

It has been proved conclusively that the employment of the blind on common labor does not give satisfactory results. The noise made by machinery appears to have a beneficial effect upon the blind and to convey to them a proper understanding of the work they perform. A further important fact is that it has been ascertained without a doubt that it is a mistake to put the blind in a special room, apart from their fellow-workers who are capable of seeing. The blind only does his best if he can compete with ablebodied workers and share with them the many daily small events happening in the workshop. Experience has shown that if all those circumstances are taken into full consideration, the blind worker, provided he is willing, is quite capable of holding his own in turning out entirely satisfactory work of the average class.

It is always assumed, however, that in the blind the feeling is aroused and maintained that he does not receive charity, but well-earned wages for services rendered which are economically valuable. The pay for piece work for the blind must be built up on the same principles as for other workers. Every facility must

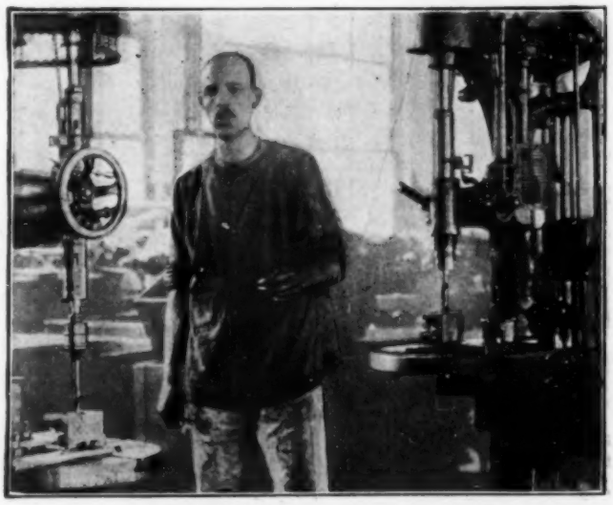


FIG. 4. A BLIND MAN OPERATING TWO MACHINES

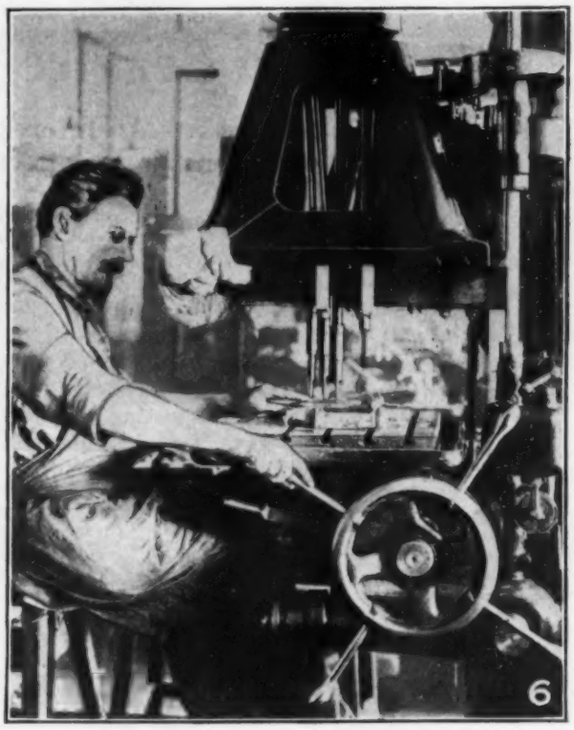


FIG. 5. A SHEET-METAL GUIDE INSURES CORRECT PLACING OF THE JIG. FIG. 6. PADS ON PROJECTING CORNERS PROTECT THE WORKER FROM INJURY

be provided which will enable them to earn the usual pay for the work performed. For special emergency cases a fund should be formed from which the blind and their families could receive assistance in time of need. It is of great importance that the management have a thorough understanding of and be in full sympathy with the peculiarities of the blind, regulating its treatment accordingly. The manager should take a personal interest in the private affairs of the blind and assist them in the solution of their problems. The sympathetic manager will always be able to find new work which the blind can perform or work suited to their needs.

The Question of Accuracy in Micrometer Measurements

By William S. Rowell

On page 562 of *American Machinist*, Mr. Sheldon asks the question: "How close can you measure with your micrometer, assuming the micrometer itself to be free from errors?" It is not only a good and timely question to ask, but all of us should thoroughly try out anything that points toward the correct answer and promises better work. He tells us of some rather remarkable results of an attempt to determine variations due to the personal element in small outside micrometer measurements.

Though we may speak of "tenths" today as lightly as the machinist of a generation ago did of thirty-seconds, we must admit a lack of real knowledge, and also that we cannot with ordinary instruments be sure we are right to one ten-thousandth of an inch. Difficulties attending the use of the more refined measuring instruments prevent the extensive use of such instruments in actual production, but it would seem no more than right or reasonable that the workman should have measuring instruments that are at least as good as those used in inspecting his product.

The checking of measuring instruments for inaccuracies, both original and those produced by wear, has always been practiced by intelligent men. The Western Electric Co. did something at it more than ten years ago. This company bought for its employees many micrometers, hardened squares, etc., and none were turned over to the workman until approved by the test laboratory. Micrometers were tested on Johansson gages at not fewer than five points.

My belief is that most men of experience along these lines will agree that an extreme variation of 0.0001 in. among twenty men is remarkable proof of ability to measure closely. Where it is stated that "a lesser number underestimated the length from one quarter to three-quarters of one ten-thousandth," the reader finds himself wondering what micrometer was used that made the reading of these small amounts possible. If this statement stands, then and then only can we say that we are as sure of ten-thousandths of an inch, as the men of thirty years ago were of thirty-seconds.

The mechanic of thirty years ago could readily split the thirty-second into ten parts with his caliper and "scale." The writer still has a *Darling* Brown & Sharpe steel rule that may be depended on to give a trained user a tenth of an inch much more accurately than ordinary outside micrometers will indicate one ten-thousandth of an inch. This leaves the present-day mechanic working among still greater uncertainties in attempting to measure a "tenth," with his "mike," than his father encountered in attempting to measure 0.010 in. with his caliper and "scale."

A little more detail of this test, especially in the matter of insulating against temperature variations, would be of interest and, in view of the much greater difficulty involved in taking internal measurements, so also would be a similar test of the ability of this same twenty men to decide the sizes of bores of one inch and less.

Automotive Service Methods and Equipment

V. Servicing the Rolls-Royce—An Interesting Grinding Job—A Hand Pipe Expansion Tool —Kelly-Springfield Truck Service Methods and Tools

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

ALTHOUGH the Rolls-Royce car is undoubtedly so designed and constructed that a minimum amount of service is necessary, that minimum is expedited by the use of special equipment, some of which is described herewith.

In Fig. 1 is shown a fixture for testing the straightness of pistons after they have been assembled in the car. As the pistons vary in size, due partly to the fact that oversize pistons are used whenever a cylinder is rebored, the pins *A* have to be adjusted frequently. The upper end of the piston is somewhat smaller than the rest of the piston, also. This is done, as shown, by resting the fixture on a faceplate and aligning the pins *A* with a square. There are four of these pins, two in each of the parts *B* and *C*. After aligning the pins, the fixture is placed on the motor as shown in Fig. 2, and the space between the pins and the piston gaged with feelers. Due to the fact that the top end of the piston is smaller than the body, all four sides of the piston are gaged. If the fixture shows an error, the rod is straightened and gaged again until the piston is absolutely straight.

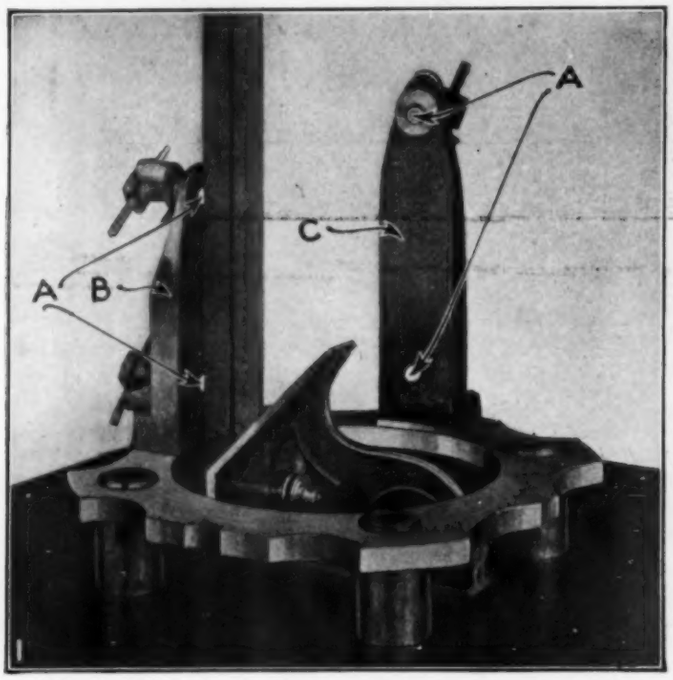


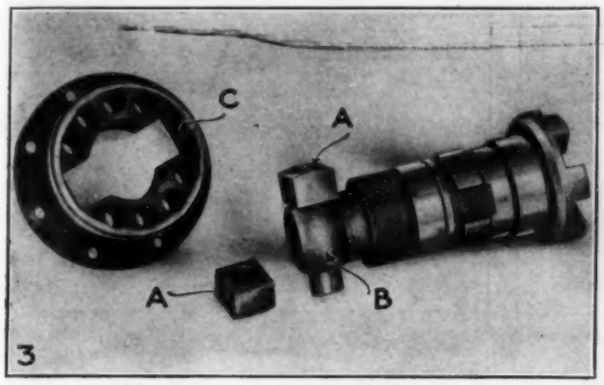
FIG. 1. TOOL FOR TESTING STRAIGHTNESS OF CONNECTING ROD.

FIG. 2. GAGING PISTON FOR STRAIGHTNESS

The principal parts of a Rolls-Royce universal joint are shown in Fig. 3. When these are assembled, the blocks *A* assembled to the pin and shaft *B*, must be a "push" fit in the slot *C*. These blocks also have a radius ground on them where they come in contact with the inside of the collar, this radius being the radius of a circle of which the length of the slot is the diameter. Fig. 4 shows how these blocks are ground. The two blocks are put on to a special mandrel made from one of the shafts, and ground with a portable grinder that is clamped into the toolpost of a lathe. To grind out the slot in the collar, this same grinder is attached to an angle plate and the angle plate is bolted to the slide-rest of the lathe with the grinder in a vertical position as shown in Fig. 5. An emery wheel mounted on a plate is attached to the grinder in such a position that the wheel can be driven from the spindle of the grinder. Then the collar is placed in the chuck with the slot practically horizontal. While in this position, one side of the slot is ground. Then the chuck is revolved until the slot is again horizontal and the ground surface is tested with both sides of the hole. When the piece has been adjusted so that the ground surface is absolutely horizontal, the opposite surface is ground until the slot is of the desired width.

SETTING A ROLLS-ROYCE AXLE PIN

An operation which is undoubtedly peculiar to the Rolls-Royce is shown in Fig. 6. The axle must be assembled to the car so that the axle-pin *A* slants 17½ deg. backward from the perpendicular. The tool *B* has a screw *C* in the bottom end which is pointed so that it will fit into the center in the end of the axle pin. A similar center is attached to the tool at *D*. This center sets into the center in the upper end of the pin. When these two centers are in place, the top of the tool is exactly at right-angles to the pin. Another tool composed of two parallel bars hinged together at one end, as shown at *E*, is now placed on the upper part of the tool. To the lower of these bars is fastened a gradu-



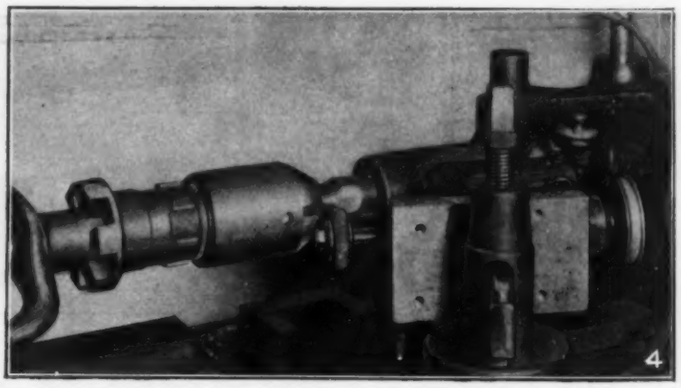


FIG. 3. UNIVERSAL JOINT PARTS (ROLLS-ROYCE). FIG. 4 GRINDING UNIVERSAL JOINT BLOCKS

ated scale *F*; on the upper bar is placed a level. The upper bar has to be raised at the open end to a certain mark on the scale *F*, then when the axle has been turned so that the upper bar is shown to be perfectly level, the axle-pin *A* will slant at the desired angle.

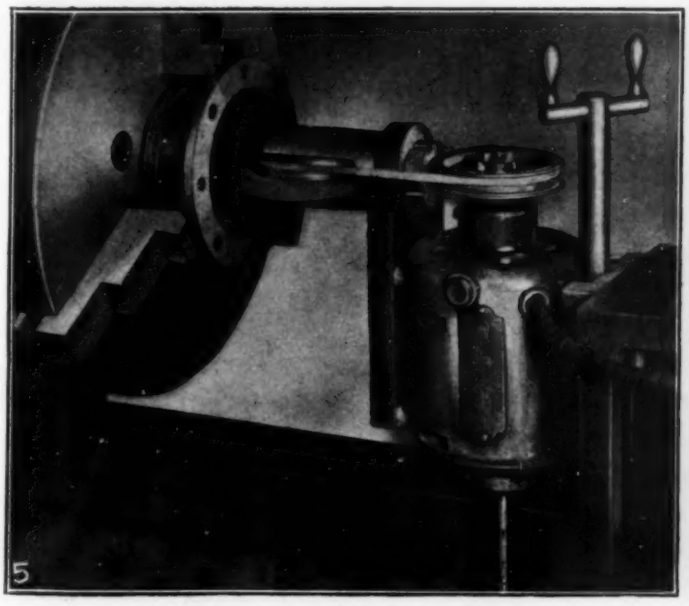
A tool for performing an unusual expanding operation is shown in Fig. 7. This is used for expanding the exhaust stand pipe at a point about 3 in. back from the end. Thus the pipe is tapered with the small end of the taper at the end of the pipe so that it will fit into the exhaust chamber. The bottom end of the spindle *A* is tapered with the large end of the taper at the end of the spindle. The three sections of a cylinder *B* are attached to the ring *C* by screws which enter through slots in the ring. These slots are loose enough so that when the spindle is drawn up through the segments *B*, these segments will be spread apart at the bottom. When the tool is placed in the end of the pipe, part *D* rests on the top of the segments, and the shoulder *E* rests on the top of part *D*. Then when the handle *F* is turned, the spindle is pulled up through the tool, expanding the pipe at the lower end of the segments. The operation of the tool can be seen in Fig. 8, only the end which is to be expanded being shown. The pipe is held in a vise for the operation.

The service station of the Enterprise Motor Corporation, New York distributors for the Kelly-Springfield Motor Truck Co., has some interesting equipment. Included in which is the motor stand shown in Fig. 9. A stand of this or a similar type is one of the most necessary articles in a modern service plant. The motor which is to be repaired or overhauled is bolted into this stand, which is so arranged that the motor can be swung to any position, making it possible to work on either the top or bottom of the motor; or it can be set vertically so that the crankshaft and camshaft gears are easily accessible.

At *A* and *B* in Fig. 9 are the motor supports by which the motor is hung in the truck chassis. These are removed from the chassis with the motor and bolted to the side-arms *C* and *D*. Each side-arm carries a 1¾-in. stud which rests in a bearing as shown at *E*, which makes it possible to swing the motor to any position. The motor is locked in a horizontal position by means of the clamps *F* and *G*, each of which is held in position by a bolt and nut. A slot in the clamp makes it possible to slide the clamp horizontally under the side-arm, the two clamps holding the motor so that it cannot tip.

In Fig. 10 is shown a unique type of crankshaft pin turning tool. This is a commercial article, made by Peters, Inc., Philadelphia, Pa. The interesting feature of this tool is that it can be used for truing up a crankpin without removing the crankshaft from the motor.

The tool consists of eight steel cutters held in an



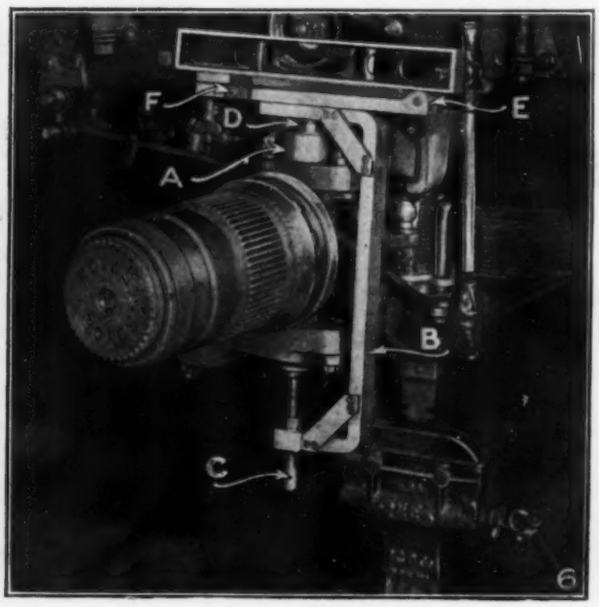
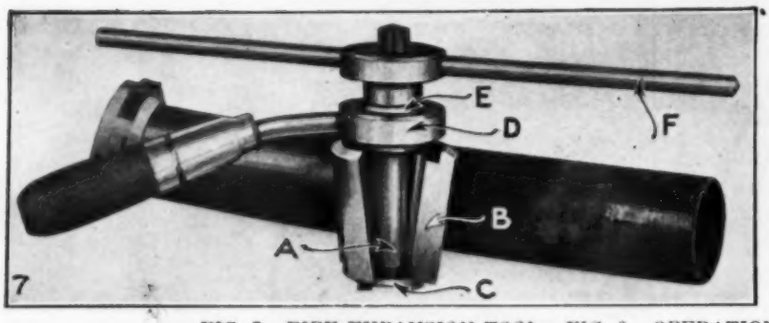


FIG. 5. GRINDING SLOT IN UNIVERSAL JOINT COLLAR. FIG. 6. ALIGNING THE AXLE PIN



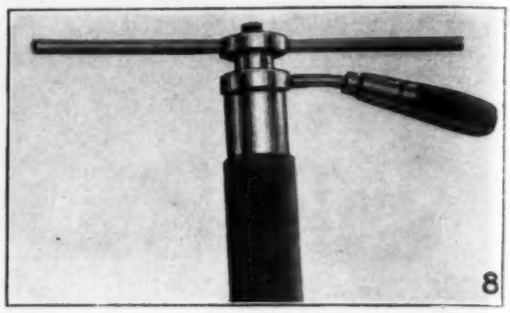


FIG. 7. PIPE EXPANSION TOOL. FIG. 8. OPERATION OF PIPE EXPANSION TOOL

adjustable screwplate, all of which are enclosed in an aluminum chuck-like housing approximately 1¼ in. wide and 9 in. in diameter. The screwplate is operated by means of a spanner-wrench, the action of turning the plate moving all cutters to or from the center universally.

FIG. 11. USING A WHEEL-PULLER TO REMOVE A TRUCK WHEEL

The housing is made in two halves, hinged together so that the tool can be opened and placed in position around the crankshaft pin, which can be done while the crankshaft is in the motor. Then the screwplate is set so that the cutters rest on the metal of the crankpin, and the tool is revolved by hand. After the high-spots are taken off, the screwplate is again adjusted and the operation proceeds until the pin is turned to the size desired.

Another very necessary tool for service station work is the wheel-puller, such as is shown in Fig. 11. The wheel is swung clear from the ground by jacking or blocking up under the axle and the puller applied as shown. The central screw *A* is a ¾-in. 10-thread setscrew, 3 in. long under the head. It screws through the part *B* and seats in the end of the axle, locating in the center hole which is usually found there. The legs *C* are ⅝ in. in diameter, and are held by the pins *D* which are ½ in. in diameter and 2⅞ in. between centers. The legs are approximately 4½ in. long. The use of the wheel puller saves the felloes and spokes from defacement and puts the strain near the seat of contact of the bearing. The two legs are catching back of the hub in this case, although the ends are formed so that they can be dropped into holes if desired. The shop superintendent states that three tons could be pulled with this small tool without any trouble.

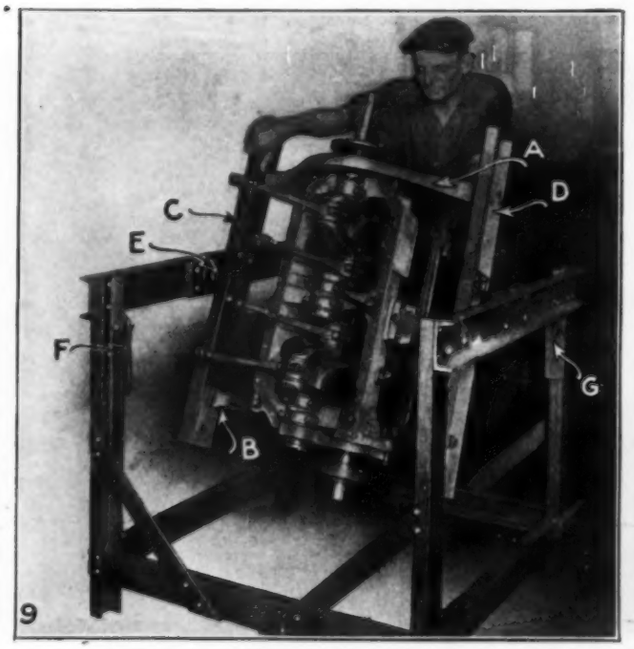
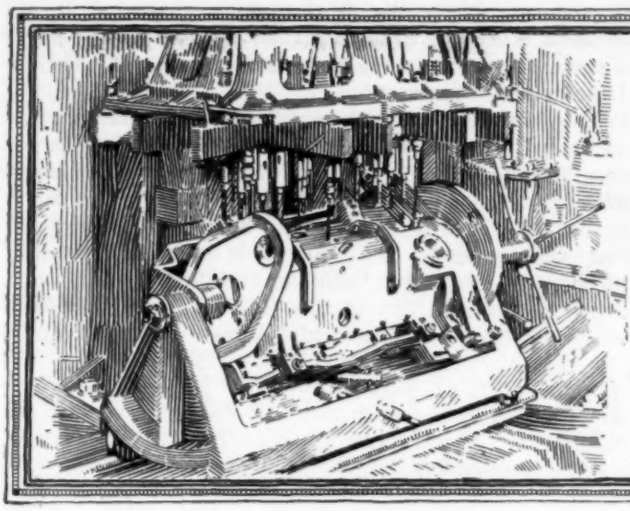


FIG. 9. MOTOR-STAND IN KELLY-SPRINGFIELD PLANT. FIG. 10. TURNING A CRANKSHAFT PIN



Tool Engineering

By

Albert A. Dowd and Frank W. Curtis

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Turning Tools for Turret Lathes Concluded—Box, Universal and Overhead Tools—Methods of Holding Tools—Advantages of Piloting for Rigidity and Alignment

IN MAKING up box tools for turning bar stock, care must be taken to avoid too much depth below the center of the turret hole. All turret tools must be indexed with the turret, and they are likely to strike the back of the turret slide if made too deep. The tool must be made adjustable, and the back rests should be so designed that they can be used either ahead or behind the cutter. A very good type of box tool is shown at *A* in Fig. 292. The portion *B* is made so that it can be fastened to the turret and suitably located in the turret hole. The overhanging portion *C* is fitted with a toolblock *D*, in which a tangent tool *E* is placed. The tool can be adjusted to the required diameter by moving the block *D*. The rollers *F* and *G* are mounted on adjustable blocks *H* and *K*. They are provided wtih screws at *L* for adjustment and can be locked in place by the nuts at *M* and *N*. This is a clean-cut design, with plenty of provision for chips, so that they are not likely to clog and tangle up on the tool.

When work is of small diameter, it is not always possible to use roller back rests, because they cannot be brought in very close to the center. A V-type of back rest like that shown at *O* can be used when such a condition is encountered. The two pieces are adjustable on the slide *P*, and are locked in place by means of the nut *Q*. In designing multiple box tools, this type of back rest is frequently used, because it takes less space than the roller type. Several blocks like that shown at *P* can be made up, and the back rests adjusted according to the requirements. They are located by means of a tongue *R* in the body of the holder. Toolblocks for multiple cutting can be made as shown at *S*, and several of them can be applied to one holder for cutting different diameters. The holder may be extended as shown by the dotted lines at *T* to accommodate several blocks.

If shoulders on the work are very close together, it may be necessary to place two or more tools in one block, and also to do away with the bolt *U* and provide a different method of fastening. This last may be accomplished by tapping into the block from the underside and using collar-head screws for holding. The designer of turret tools is not frequently called upon to design box tools, although there is an occasional demand for a tool to handle work which cannot be taken care of by the standard types. The information given here should be sufficient to bring out the principal points in connection with the design.

Another type of tool used for bar work is shown at *V*. It is a pointing tool, used for chamfering the ends of bar stock preparatory to turning. The design is very simple and consists primarily of a casting with a shank fitting the turret of the machine. A hardened conical bushing *W* is cut away at one side to allow the tool *X* to act against the work. The bushing, being tapered, supports the work and centers it while the chamfer is being cut.

Universal Turning Tools

An adjustable tool suitable for turning cylindrical work is shown in Fig. 293. The work *A* is to be turned on the two diameters *B* and *C*. It is possible to design a tool to handle work of this kind so that it will be adjustable for all diameters within its capacity. The tool holder, shown at *D*, is fastened to the turret of the machine by means of screws at *E*. It is machined with a dovetail as indicated at *F*, and a slide *G* is fitted to it. An adjustable gib is provided at *H* to take up wear. The slide is adjusted vertically by means of the screw *K*, which enters a hardened threaded bushing *L* in the body of the holder. The sliding member *G* has a tool *M* set at an angle of 30 deg., in order to allow working close to a shoulder.

A tool of this kind can be fitted with a graduated handwheel and a pointer, in order to permit of accurate adjustments. Combinations are occasionally made with a holder for drilling or boring, in connection with this tool. The holder can be placed in the hole *N*. If necessary, this portion of the body can be extended to form a rigid support. Tools of this general type can be fitted with a slide having a tangent tool for short cuts on bar work; but as the holder is not provided with back rests, it cannot be used for very heavy cutting.

By setting the slide at an angle, as indicated at *O*, space can be obtained for the two back rests, as shown at *P* and *Q*. These back rests are adjutsable by means of screws at *R* and *S*. They can be designed so that

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either leading or following rolls can be used. A detail of the construction of the slide is shown at *T*. The screw *U* is utilized to adjust the blocks toward the center or away from it. In designing tools of this sort,

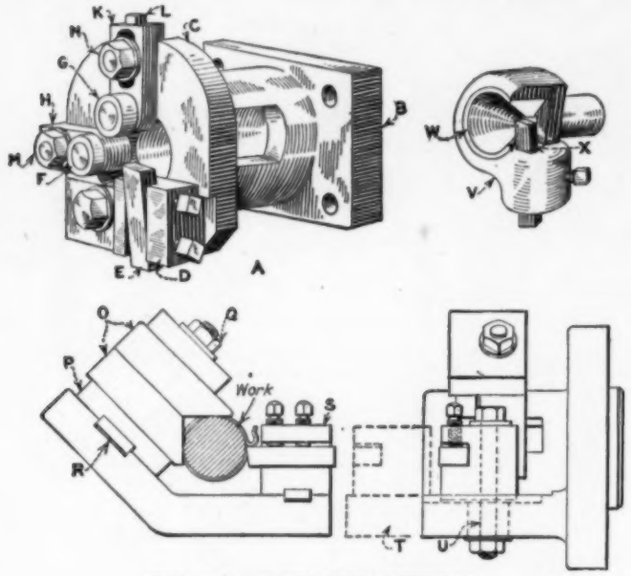


FIG. 292. BOX-TOOL DESIGNS

rigidity is an important consideration, as any vibration in the tool will cause chatter in the work. The amount of space available affects the design very strongly, and the greatest care must be taken to keep the various parts within the space permitted, so that no interference will be caused in the indexing of the turret or by the position of other tools on adjacent turret faces.

Tools of the overhead variety can be given additional rigidity by extending them entirely across the turret, as indicated at *A* in Fig. 294. These tools are applied to the flat form of turret. Two heavy brackets are provided at *B* and *C*, and through these a double-end bar *D* is passed. This bar is cut in the center at *E*, and one end is piloted and held in place in the other bar by a screw *F*. The brackets *B* and *C* are fastened to the turret by the screws *G*, and location is obtained by the tongue *H*, which fits a slot in the turret. Each end of the bar is slotted for the tools *K* and *L*. Backing-up screws may be provided for the latter, if desired. The amount of overhang at *M* is determined by the size of the bar and the work which is to be done. It is advisable to make the overhanging ends of larger diameter than the rest of the bar, if heavy cutting is to be done. The tie across the turret makes a very substantial construction, and gives greater rigidity than when single tools are used. The diameters which can be cut with a bar of this kind are limited, on account of the vertical position of the tool. Work of smaller diameter than that shown can be turned if the tool does not extend too much below the bar.

When larger diameters are to be cut, an arrangement can be used like that shown at *N*. Two brackets *O* and *P* hold a bar of similar kind to that just described, but the work is machined from the side instead of overhead. Some turret lathes have an adjustable head, while others use an adjustment on the turret. In either case the diameters are obtained by an adjustment of the relation between the turret and the spindle. When using bars of this kind, the method of holding the tool is important. If the bar is slotted, as shown at *Q*, a filler block *R* can be used to stiffen the end of the bar and prevent it from springing open. This gives a rigid and economical construction.

Tools of rectangular section, which can be purchased in standard stock sizes, should be used wherever possible. The portion of the tool which is not used for cutting should not usually be ground or finished in any way, but it should be held in the holder in the rough state. Consequently, slots for tools should be made from $\frac{1}{32}$ to $\frac{1}{16}$ in. larger than the specified size of tool which is to be used. In certain kinds of box tools for small work, tools are finished all over and carefully

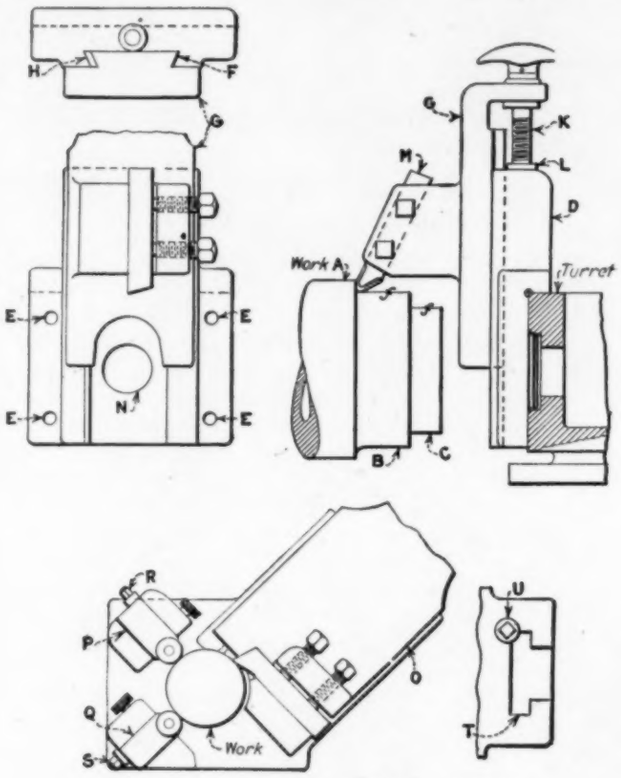


FIG. 293. UNIVERSAL TURNING TOOLS

fitted to the holders; but on larger work this is seldom done, except in the case of a very complicated piece of work.

At *A* in Fig. 295 is illustrated another matter of importance. The tool shown at *B* is held in an overhead turning tool made of cast iron. As the operator stands at the front of the machine, it is much more convenient for him to be able to make all adjustments from this position, than if he is obliged to walk around behind the machine for this purpose. Therefore, the setscrews *E* are conveniently placed at the front of the tool. This is not theoretically correct, because the thrust of the cut is in the direction indicated by the arrows, so that it must be taken by the setscrews instead of against the solid metal. This is a case where theory and practice do not coincide.

If the designer places the setscrews as shown, care must be taken to make the section *D* very heavy, so that there will be plenty of metal to absorb vibration. If made as shown, section *D* is too thin and section *C* much heavier than it needs to be. These conditions should be reversed, so that the appearance is more like that at *F*. The same thing applies to an adjustable

toolblock which is mounted on a holder with tools arranged for the same kind of work. There is another point of importance in the method of holding tools. If they are made as indicated at *G* and *J*, it is wise to provide for a certain amount of play in the slot, as shown at *H*. This will permit tool *J* to be adjusted in a certain relation to tool *G*, even if there is considerable variation in the way each tool is ground. If both tools are fitted carefully to a slot, it is very difficult to set them for exact work unless they are ground to a gage.

A setscrew which is used to hold a tool in position appears to be a very simple matter, yet certain types have been found unsuitable. The cup-point screw, shown at *K*, is usually unsuitable for holding tools, because the cup point tends to make an impression in the tool. After the tool has once been ground, the setscrew will naturally find its way back to the original marks, thus making it very difficult to obtain a correct setting. The same thing applies to the use of a round-end screw, and neither of these types should be used in toolholders. In addition to these points, a setscrew having a head like that at *K* is not as convenient for the operator as a collar-head type of screw, because the wrench slips down over the head, thus causing delay and inconvenience. The ideal form of screw for holding tools is shown at *L*. It is a collar-head type with a flat relieved point *M*. There are certain cases where this type is objectionable on account of the collar, particularly when a number of screws are placed in a holder quite close together. In general, however, it is advisable to use it wherever possible.

The material from which screws are made has been the subject of considerable discussion, because the ordinary commercial screws often break under excessive use. The writers have found Hy-ten steel, suitably treated, to be admirably adapted for setscrews requiring severe service.

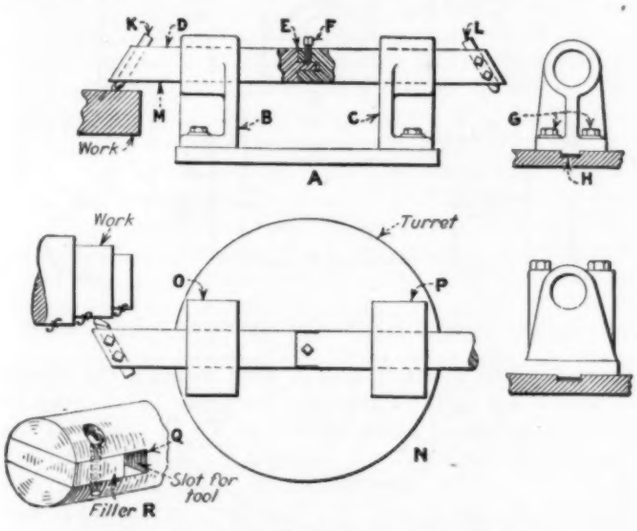


FIG. 294. OVERHEAD TURNING TOOLS

There are several forms of multiple toolholders which are capable of considerable adjustment, and can be used for quite a range of work. One of these is shown at *N*, this type being a casting having a center boss *O* and two holes *P* and *Q* at different distances from the center. Tools can be inserted in all three of these places, so that diameters approximating those shown by the dotted lines at *R* and *S* can be easily machined. Variations in the shoulder distances can be taken care of by longitudinal adjustment of the bars *P* and *Q*. A drill or boring bar can be inserted in the hole at *O*.

Another multiple tool is shown at *T*. This holder is provided with one central hole and three others arranged at different distances from the center. A rectangular slot is also cut at *U*, so that facing or turning tools of rectangular section can be held according to requirements. Another simple holder having four holes is shown at *V*. Its general principles are similar to those of the other holders.

Any multiple holder which is to be used as a standard tool and subject to considerable variation in the class of work to be handled, must be rigidly designed and proportioned in such a way that it will be as adaptable as possible. The bars used in the holder can also be standardized, so that they can be used for turning and boring. Holders of this general type are often purchased from turret lathe manufacturers.

Advantages of Piloted Tools

In order to obtain maximum production from turning or boring tools, they should be piloted so that all possibility of vibration is eliminated. Under these conditions only can high production be obtained, together with the essential degree of accuracy. In the piloting of turret tools two points are achieved, one of these being the additional rigidity obtained by the use of the pilot and the other the accuracy of alignment. It is not always possible to pilot a turning tool, due to some condition on the machine or the work.

In the example *A* shown in Fig. 296, the work *B* is to be turned by the tool *C* in a holder *D* on the face of the turret. In order to assist in aligning the tool, and to help in making it more rigid, a bushing *E* is placed in the chuck and the bar *F* is guided by it during the operation of turning. The bar can be furnished with a cutter for boring the hole. This method will give some additional stability to the tool; but, as its position is at the center of the work, it does not prevent sidewise vibration to any great extent.

A much better arrangement is shown at *G*, in which a smaller piece of work is being turned by the tool *H* in

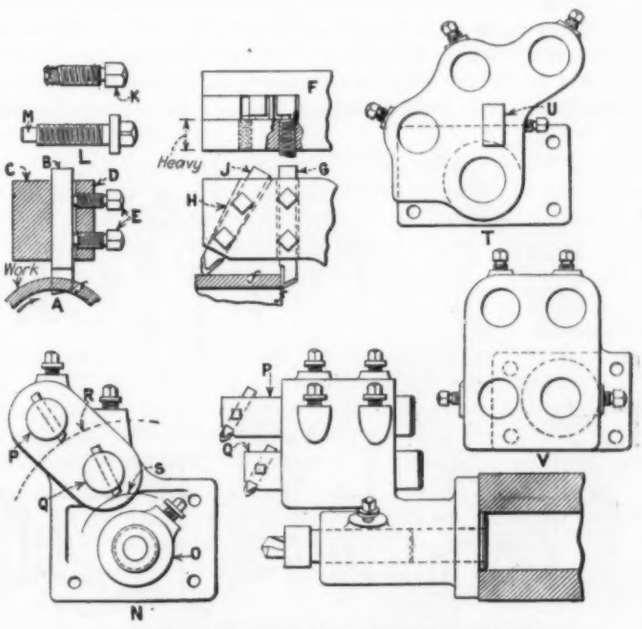


FIG. 295. METHODS OF HOLDING TOOLS

a holder *K*. The latter is furnished with a pilot bar *L* which is guided in a bushing *M*, the latter being held in a special bracket *N* on the spindle cap of the machine. This arrangement gives the tool an excellent support at the point where it is needed, and at the same time assists in the alignment.

The same piece of work could be bored at the same time by arranging the holder so that the boring bar *O* could be used in it. This boring bar being piloted in the chuck, as shown at *P*, would give additional support to the holder and make a very substantial device. There are usually slight inaccuracies in the indexing of the turret, and piloted tools assist greatly in correcting them, so that more accurate work can be produced in this way.

It may be objectionable for one reason or another to use a pilot on the turning tool itself. When this is the case, it is possible to use a bracket, as shown at *Q*, furnishing it with a pilot bar *R*, so arranged that it will enter a place provided for it in the holder at *S*. The work *T* can be simultaneously turned and bored by a tool of this kind. The turning tool is not shown, as it lies in a different plane from that of the pilot bar. This method of piloting is not as good as the other, because the alignment of the bar is dependent upon the short bearing obtained by the bracket at *X*. It is useful, however, for cases where the regular piloted tool cannot be used.

The brackets which are used on the spindle cap to support the bar of a piloted turning tool must be designed according to the headstock arrangement of the machine. Sometimes it is not possible to place the bracket directly over the spindle, and it may be necessary to select some other place for it. Several varieties of brackets are shown in Fig. 297. The example at *A* is a plain, symmetrical casting *B*, which is fastened to the spindle cap by means of four bolts at *C*. The bracket is furnished with a bushing *D* in which the tool is piloted. Usually this design cannot be used, because it is directly over the spindle, which would normally be in line with the position of the cutting tool. The pilot would more frequently be placed at the right- or left-hand side of the tool, as this would not require the bushing to be made so high above the spindle, and would allow greater latitude for the turning tools. When a pilot bracket is fastened to the spindle cap, the latter should be taken off and machined so that a good fit is obtained. It is advisable also to make sure that the cap

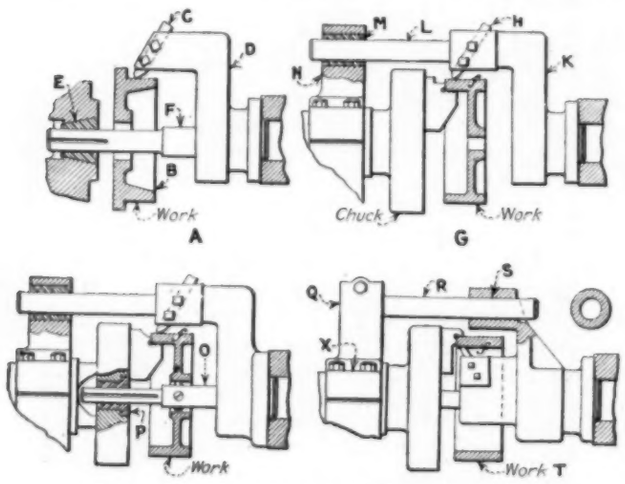


FIG. 296. EXAMPLES OF PILOTED TOOLS

is adjusted properly before doing any fitting of the bushing *D*. The bracket should be doweled in place in order to insure its proper alignment.

The example at *E* shows a pilot bracket having a bushing *F* at the right of the spindle and considerably above it. In the example *G* the bracket forms a unit with the spindle cap itself, being designed specially to replace it. The position of the bushing *H* is at the left of the spindle in this example, and this is really the proper place for it to obtain the best results.

If we consider the cutting action of the tool, there is a slight lifting tendency, which is more or less counteracted by the pilot. There is at the same time a tendency to pull the tool toward the front of the machine, due to the direction of rotation of the work. As the bushing *F* is to the right of the spindle, the lifting action will not be counteracted to as great an extent in this case as in the example *H*, where the bushing is to the left. In the latter case, the pressure of the cut gives slightly more downward force.

A very good example of a rigid, piloted turning tool is shown at *K*. The work *L* has two shoulders which are to be machined with considerable accuracy, and a large amount of stock is to be removed. The turret is fitted with two brackets *M* and *N* on opposite sides. Each of these brackets has a heavy section of metal *O* which extends out from the face of the turret and carries the tools *P* and *Q*. A long tie bar *R* extends entirely across the turret and is fastened in each

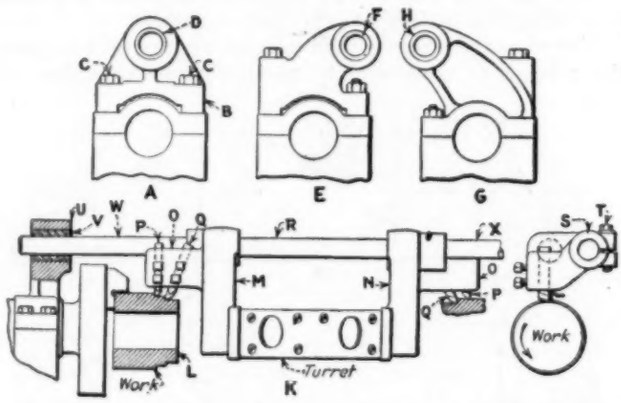


FIG. 297. PILOTED TURNING TOOL AND BRACKETS

bracket. The pilots *W* and *X* pass through the bosses *S*, which are split so that the bars can be clamped in place by means of pinch binders at *T*. A bracket *U* on the spindle cap carries a bushing *V*, in which the bar is piloted. The construction is such that the two brackets *M* and *N* are tied together very rigidly, and the bar gives an excellent support for the turning tools. For large diameters, long work, and other pieces which require exceptional accuracy in machining, the use of piloted tools is indicated and will be found a decided advantage in increasing production and giving greater accuracy.

Several forms of piloted turning tools have been illustrated, and their application to various kinds of work described. The principles of design are fundamental, yet they serve to make the subject clear by their simplicity. In order to demonstrate the value of the data given, two examples of piloted tools of improved design are shown in Fig. 298. The large casting *A* is to be turned at *B* and grooved at *C* and *D*. The tools used are designed so that they can be adjusted to handle

another piece of work of the same kind, but 2 in. smaller in diameter.

The casting is held by the outside of the flange in a three-jaw chuck with special jaws. The turning-tool

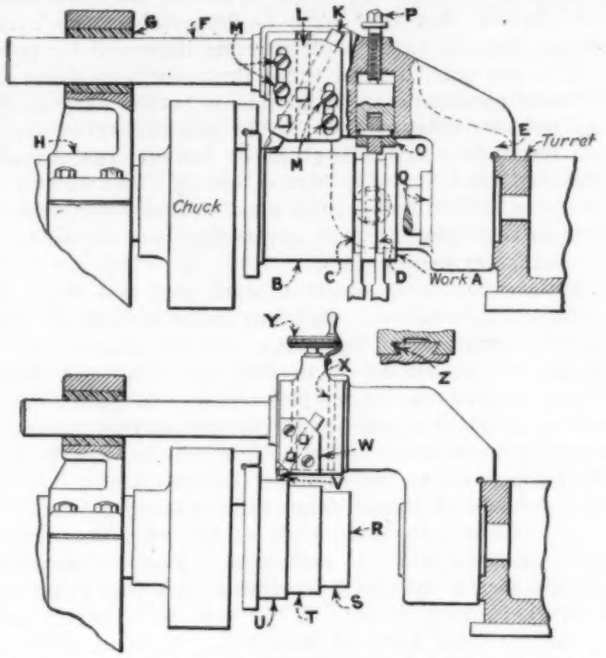


FIG. 298. ADJUSTABLE PILOTED TURNING TOOLS

body *E* is of cast iron of substantial section, fitted and bolted to the turret face. The forward end of the tool body is provided with a heavy pilot bar *F*, which enters a bushing *G* in the bracket *H* on the spindle cap. The cutting tool *K* is mounted in the rectangular steel block tongued at *L*, so that it fits a slot in the casting, which acts as a guide when adjusting the block vertically for different diameters. The screws at *M* are used to hold it firmly after setting. Fine adjustment of the tool *K* is obtained by means of a backing-up screw not shown.

The grooves at *C* and *D* are cut by two tools in the cross-slide toolblock. They are shown in the illustration 90 deg. from their actual position, in order to avoid complications in the drawing. In order to save time in the operation, the grooving tools are started before the turning is completed. Two roller supports are used to give stability to the work and steady it while grooving. One of the supports is shown at *O*, with an adjusting screw above it at *P*. The other is at the back of the work directly opposite the grooving tools, as shown only by the dotted lines.

This tool arrangement may be considered as a progressive design suitable for high production of accurate work. The general outline of the tool is pleasing to the eye and free from sharp corners and projections. The operator's convenience has been considered in the provisions for accurate adjustments, and its stability is apparent even to the casual observer. In fact "it looks efficient" as it really is. Adaptability to other work has been considered in the design, as shown by the central boss *Q*, which is bored out so that it can be used to hold a boring bar or cutter head, if desired.

Another overhead tool is shown in position for turning the work *R*. The pilot bar, bracket and body of the tool are quite similar to the one used for casting *A*, and the body is fastened to the turret in the same manner. This tool is designed for turning several diameters like *S*, *T* and *U*, successively and with precision. The cutting tool *V* is mounted in a block *W*, which is fastened to the dovetailed slide *X*. The latter is controlled by a graduated handwheel *Y* by means of a screw. The slide is furnished with an adjustable taper gib *Z*, as indicated in the sectional detail. Readings for various diameters can be easily obtained from the graduations on the handwheel. This tool should not be considered strictly as a high-production type; but for work of the kind shown, which is routed through the factory in lots of 100 pieces at a time, it will be found a great time saver.

Why Some Good Ideas Don't Work

BY J. E. BULLARD

A well known industrial expert while giving a talk to a body of engineers gave it as his opinion that bonuses, selling stock of the company to employees, suggestion boxes and profit sharing, were not as a general rule practical methods of creating greater interest in the work and in the company or in increasing production. He not only gave this as his opinion but backed it up by citing many cases that had come under his observation.

At that same meeting an executive told of the great success that had resulted from a bonus system that had been in operation in his own company for ten years. The bonuses ran high during good years; in bad years there was some bonus and production had very greatly increased without a comparable increase in the number of employees or the pay roll.

Some so-called employee magazines have never been a success. It has been almost impossible to get the employees to read them and if they do read them it appears to do but little if any good. Other employee magazines are very great successes from the start and everyone not only reads each issue from cover to cover but looks forward to the next issue.

No idea, no matter how good it may be, can be expected to work equally well in each of two different plants, not even in two different plants of the same concern. Sometimes it is perfectly obvious why this is so and sometimes it is hard to find the real reason.

In some plants the management has no difficulty in making it obligatory to wear certain safety devices or articles of clothing that tend toward safety. In other plants the men would strike if such a regulation was put into effect.

Systems are working to the advantage of everyone concerned in some plants which would completely disrupt the whole organization in others. Apparently there is no way of telling what may be expected in one organization from a system that has worked well in another.

This, however, is not the case to such an extent as is generally supposed. It is not the system that is at fault as a rule but the executives who carry out the system. Some systems require a great deal of leadership. This is especially the case with those which prove most successful in practice in one plant and fail completely in another.

It has been the leadership and not the system that has secured the desired results. The profit sharing, the bonuses, or whatever else may be a prominent feature, is not at the root of the success at all. It is merely an offshoot. It has been the leadership of the men at the top; of the officers of the company; of the

superintendents and the foremen, that has gained the result. Give any other organization the same sort of leadership and the same plan will succeed in that organization. In fact with the right leadership, no innovation will be made until the rank and file of the employees are ready for it.

It is the editorial policy of many an employee magazine and the attitude of the editor towards the paper and its readers that causes many, if not most of those that fail, to miss their aims. The editor is probably not a good leader. He is too far away from the readers to understand their problems and their habits of thinking. In other words, he can't see them and as a result he misses the mark just as a person shooting at a target would be more than likely to miss it if he could not see it. Such an editor cannot make a success of the paper even if he has an advisory editorial board of the workmen themselves. He cannot understand them. He cannot think as they do. He is probably not in sympathy with any of their points of view. Probably some workman who has only a very limited command of English would make a far better editor of that magazine.

Until a new editor is found that paper can never succeed. One who can command the trust and the respect of the men; one whom they believe in.

It, however, is not always the fault of the editor that the paper fails. It may be the fault of his employers. They may not allow him to publish a paper that will prove of real interest to the men. They may insist too much upon their own personalities being placed in the paper.

An analysis of the employee magazines that do succeed will cause one to remember the words of Lincoln: "Of the people, by the people and for the people," and pharaphase them into: of the employees, by the employees and for the employees. Those that fail will usually measure up to the formula: of the employers, by the employers and for the employers, at least as far as their reaction upon the employees is concerned. They fail largely because they have at least the appearance of being published in the interests of the employer rather than of the employee. In fact they might be called employer magazines that circulate among the employees.

It matters not what class of publication it may be, it will never succeed unless it is of the readers, by the readers and for the readers. That is, it must deal with matters of the readers, matters in which they are interested. It must be by the readers to the extent that the editors get from them in one way or another the information, the news or the questions in which they are interested. It must be for them in that it helps them along the lines they want to be helped. It is only by a slow and gradual process that the habits of thinking of these readers can be changed.

Because this formula is not followed employee magazines fail. When it is followed they succeed. The magazine may be edited by the workmen themselves, it may be edited by foremen, or superintendents; it may be edited by one of the officers of the company or by a professional house organ editor. It does not really matter much who is the editor just so long as that editor has the right spirit and is able to make the workmen believe that they have an important voice in its policy; that the paper is of them, by them and for them.

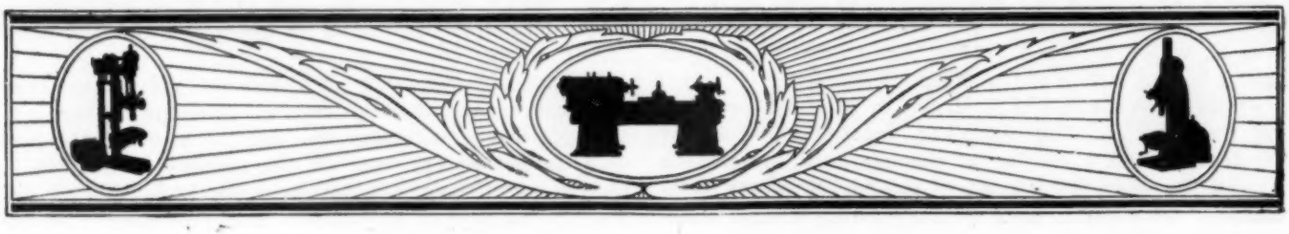
It is the spirit of the thing that counts and not the outward appearances. It is what is between the covers and not how it is printed. A few mimeographed sheets and the right spirit will go much farther than a costly prepared book and the wrong spirit. The employees will read the mimeographed sheets eagerly but will refuse to read the fine book unless they are forced to do so on the company's time.

A foreman or a superintendent may not have the right spirit, while an official or someone entirely outside the organization may have. On the other hand the official or the outside man may also lack the spirit. In any case as soon as the right man is found for editor and he is given a reasonably free hand that magazine is going to succeed. That editor will be able to lead his readers along the path he desires them to go but he never will be able to drag them or to push them.

It is always the man back of the idea that counts more than the idea. If some man suggests a good idea and the idea is his own it is often a good plan to set him at work to carry it out. If he does not make it work he will at least have to modify it. If he is given an opportunity to try to carry it out he will try much harder to make it a success than would anyone else. If it does fail and no obstacles have been placed in his way, but instead help has been extended to him, he can blame no one but himself.

After all the real problem is to find the man. A business man who has made a uniform success of his business from the time he started it stated that his sole problem was developing men and women for more responsible positions. He devotes practically his whole attention to that and has built up an extraordinarily successful business. He places the man first and the method second. If the man does not fit the method or the system, he is more inclined to change one or both to fit the man than to hunt around for a man to fit them.

Some excellent ideas fail because they do not fit the conditions where they are tried out. The ideas may fit big men and be tried out on small men or they may be small men ideas and be tried out on big men. In either case there is a misfit and dissatisfaction all around. There is nothing wrong with the idea any more than there is anything wrong with a suit of clothes that is made for a fat man, but that does not mean that the idea will fit all conditions any more than a suit for a fat man will fit all men. Some ideas are as out of place as the tools for a 48-in. engine lathe would be on a jeweler's lathe. Fit the ideas to the conditions and the men who are to carry them out, and those ideas will never completely fail. Overlook this important point and most of the new ideas applied will come to naught.



Gold-Dredge Bucket and Other Work

Manganese Steel Used for Lips—Oxy-Acetylene Torch Cuts Holes Located by a Jig—Operations on Other Parts—Repairing a Large Pulley

BY FRANK A. STANLEY

THE photograph, Fig. 1, shows a large number of gold dredge bucket lips in the yards of the Natomas Company of California, at Natoma, Cal.

This company operates a number of gold dredges and maintains at Natoma a machine plant and forge shop for repairing, overhauling and replacing various mechanical parts of its dredges. The bucket lips in Fig. 1 are only a part of the number to be seen at the plant. A gold dredge operating a chain of say, 80 to 100 buckets is working constantly under severe conditions of service and there is necessarily considerable wear on such members as bucket lips, bucket pins, ladder rollers, tumblers, sheave wheels and other parts. There is therefore much of interest to be seen in a shop devoted to the upkeep of equipment of this character.

In Fig. 2 a 15-ft. nickel chrome bucket is shown under a radial drilling machine for the drilling of the holes around the edge to receive the rivets for the lip. A bucket with the lip in place may be seen in Fig. 3.

Much of the work on buckets is accomplished with the oxy-acetylene torch. The lips are of manganese steel, and in fitting new lips to the buckets the lips are used as templets or jigs and the torch is applied through their holes to burn out the mating holes in the buckets. In stripping worn lips from their buckets the torch is

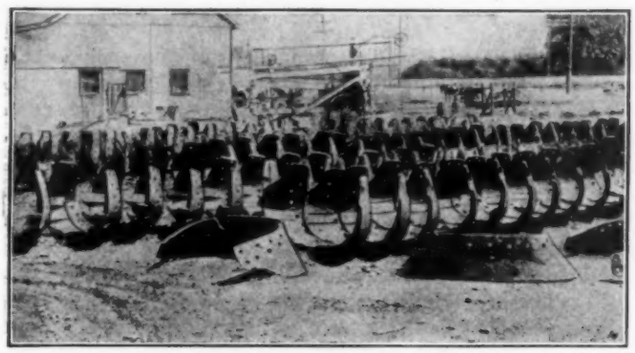


FIG. 1. MANGANESE STEEL LIPS FOR DREDGE BUCKETS

used to equal advantage in burning off the heads of the rivets so that they may be knocked out of place.

There are many other jobs of similar character around the works where the gas torch is applied to marked advantages. One operation of this kind is in reinforcing the side flanges of the tumblers over which is passed the heavy train of buckets when in operation on the dredge. These flanges, taking the side thrust of the bucket chain, are subjected to severe wear and as they are very heavy manganese castings they are expensive to renew. Consequently when the flanges have worn to a certain point, manganese steel plates are riveted on to the inner faces to form new wearing surfaces. The oxy-acetylene torch is here applied through the holes in the reinforcing plates to burn out rivet holes in the flanges proper, an operation which is accomplished very quickly.

Referring again to Fig. 3 an interesting feature of design in the bucket lip will be noticed. The front of the lip proper along the lower edge is offset in respect to the remainder at what might be termed the heel. This front portion of the lip therefore looks down over

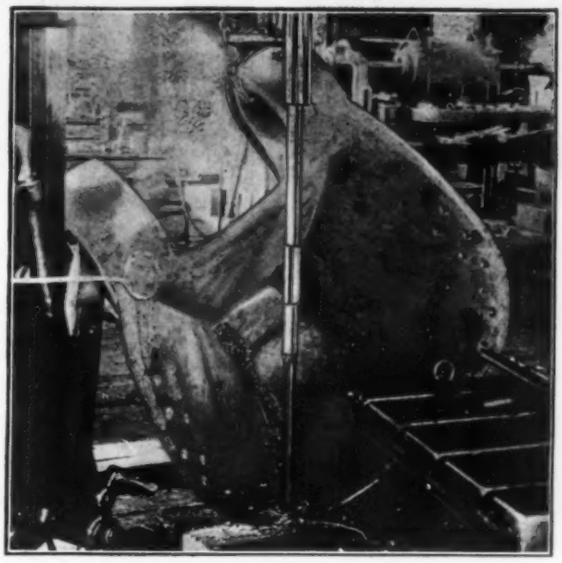


FIG. 2. DRILLING A BUCKET TO RECEIVE THE LIP

the upper edge of the bucket while the remainder of the lip immediately behind it fits inside of the bucket edge. Thus a broad continuous shoulder or ledge is provided along the lower edge of the lip, so that the heavy thrust of the lip when in service is taken directly against this contact shoulder instead of upon the rivets themselves, which are thus freed from shearing stresses.

In Figs. 4 and 5 two shop operations are illustrated on sheave members. Fig. 4 shows a 24-in. shore-sheave wheel for a 1¼-in. cable, in the engine lathe where the operation of boring out the hub is being performed. The wheel is of cast steel. It is gripped in the lathe chuck as indicated and centered to run true, then bored through the hub by a single point cutter carried in a

FIG. 3. BUCKET WITH LIP RIVETED IN PLACE

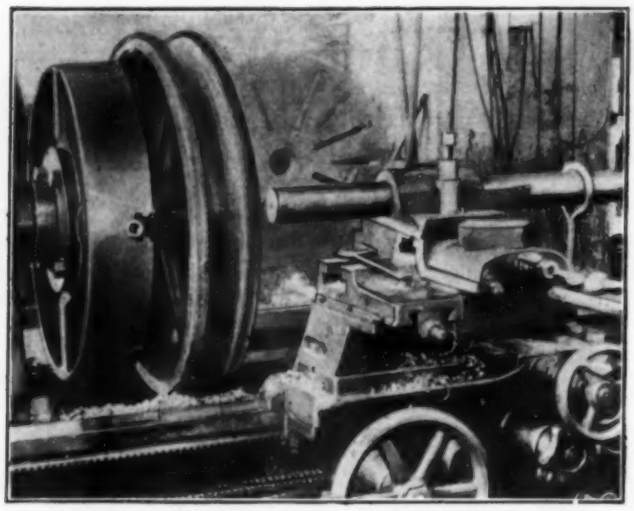


FIG. 4. BORING A SHEAVE

stiff boring bar. This bar is mounted in a heavy block of sufficient width to give a long bearing seat for the bar and the block is so fastened to the top of the lathe cross-slide as to provide for rigidity under the action of the cut. In Fig. 5 a method is illustrated for machining the housing for this sheave wheel. The housing is of cast steel and ordinarily there is about ¼ to ½ in. of metal to be removed across the edge and across the surface around the central bore. The area between these two finished surfaces is recessed in the casting to reduce the width of metal to be machined.

The work is shown set up in a 72-in. vertical boring

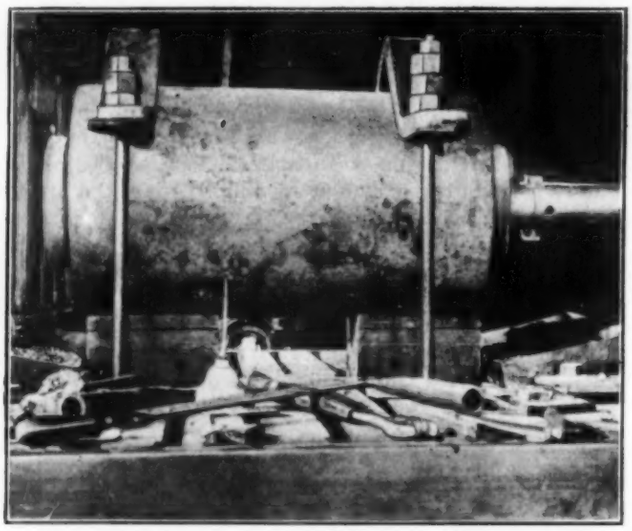


FIG. 6. BORING A LADDER ROLLER

and turning mill. Faceplate chuck jaws are mounted in the slots of the boring mill table and grip the housing by its outer edge. Holding down straps are applied at three or four points around the edge, where they are so positioned as to be clear of the cutting tool during the rotation of the work. High-speed steel tools are used for the operation which is accomplished at about 70 ft. surface speed per minute.

The photograph reproduced in Fig. 6 represents a ladder roller being bored out to fit on its shaft. These rollers are steel castings 18 in. in diameter by 2 ft. 11 in. long overall. Other sizes of rollers are made for different dredges. The rollers take the weight of the buckets as they pass up into the dredge and thus act as idlers for supporting them. Owing to their heavy duty they have to be mounted on their shafts under high pressures. In the case of the roller illustrated the hole for the shaft is 5¼ in. in diameter and the length bored out at each end of the roller is 8 in. Between these bearing surfaces the rollers are cored out inside to clear the shaft. The total length of the shaft is a little over 5 ft. and the pressure under which shaft and roller are put together is approximately 100 tons. The illustration shows one of the rollers in position in a horizontal boring machine, where it is secured in two V-blocks on the table by heavy V-straps passed over the top and drawn down by through bolts slipped into the T-slots in the table. The boring cutter is a high-speed tool of the flat type, fitted in a crosswise slot in the boring bar.

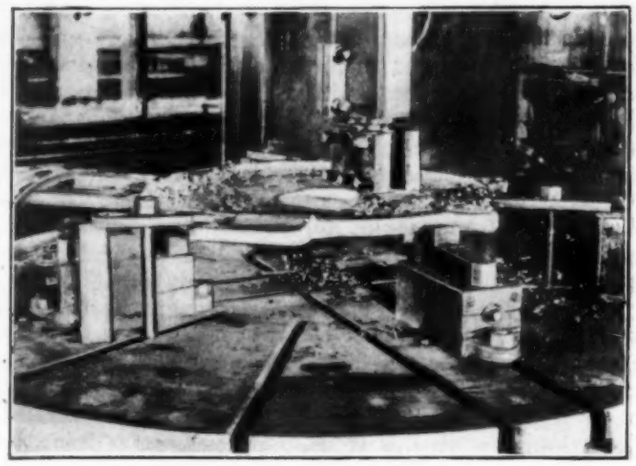


FIG. 5. MACHINING A SHEAVE HOUSING

Another class of work attended to at the shop is the repair of big driving pulleys such as the one shown in Fig. 7. This is a split pulley 14 ft. diameter, 36 in. face and 8 in. bore, and is used on the main drive of the dredge, the drive being geared down to the bucket train and other operating parts. The pulley is driven by a 32-in. belt, the span of the belt or the distance between pulley centers being about 40 ft. The drive is from a 350-hp. electric motor and the speed of operation is about 800 revolutions per minute.

The pulley is built up in the manner indicated, with arms of heavy flat section riveted to the rim of the wheel. The repair illustrated consists in putting reinforcing plates around the hub to extend for some considerable distance outwardly along the pulley arms.

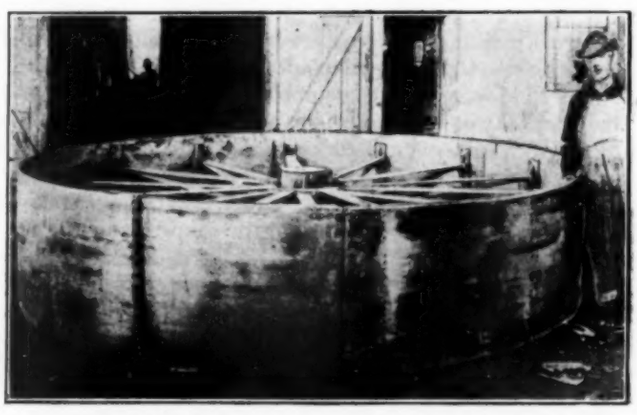
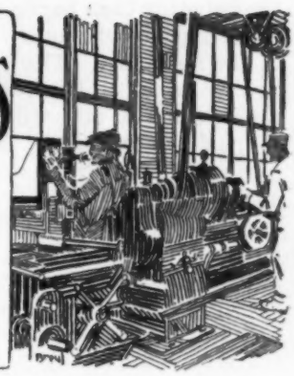


FIG. 7. REPAIRING A 14-FT. PULLEY

MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



XXV. Special Cases of Time Study and Rate Setting

Sample Time Studies on Engine Lathe, Surface and Chucking Grinding Machines and Semi-Automatic Turret Lathe—Five Steps in Setting Rates

IT IS OBVIOUSLY impossible to describe the procedure for taking time studies on every job that can conceivably be done in a machine shop. The best that we can do is to present certain typical problems and show how they were solved. Then the individual machine shop executive must try to choose time study men who are ingenious enough to work out a solution for each puzzling problem. In the preceding articles I have outlined the fundamental methods of time study, the setting of standards and rate setting. It seems well in this article to touch upon some of the special considerations which apply to making time studies in various typical machine shop departments, which will indicate how the problems are attacked. All of the studies cited in this article are actual ones and are chosen because they present typical conditions.

A Lathe Department Problem

Where the peculiarities of the stock introduce a variable for the same operation, several studies may be needed before the correct rate can be set. A case in point was the "cut off and recenter" operation on shafts in a certain automobile shop. Most of these shafts turned out in two operations, one turning on each end. It was most economical to have the blank somewhat in excess of the length of the finished shaft with the result that the operator took the finished shaft out at slightly varying distances from the ends of the blank. The excess stock must be removed in the operation "cut off and recenter." The amount of stock to be cut off on an end will vary, and whether or not the shaft must be recentered will depend upon the amount of stock removed, which in turn determines the time required and whether the performance "recenter" must be made. Obviously, we could not determine with any certainty what the standard time should be without knowing the average amount of stock to be removed and the average percentage of recentering to be done, for without knowledge of the average condition we could not say with certainty that any given study or group of studies would be representative.

To get a basis to work on, the man who inspected the finished shafts after turning was required to record the length of stock to be removed from each shaft, whether recentering was required, and the diameter of the dead stock. From this record, after a sufficient number of observations had been accumulated, it was found that the average length of dead stock was 0.0127 in. at a diameter of $\frac{5}{8}$ in. and that recentering was required on forty-three out of every 100 shaft ends. With this information, the standards for all shafts could be built up by determining the standard time for a single cut, the amount of stock removed by this standard cut, and hence, the number of standard cuts to be allowed per shaft; adding to this 43 per cent of the standard time developed for recentering; and then fitting in the easily supplied standards on the other performances, such as "mount" and "dismount part."

A Surface Grinding Machine Problem

In one shop gears, collars and the like were ground to specification on the surface grinder. Regardless of the size of the parts themselves, the amount of stock to be removed in the grinder does not vary a great deal, since the limits of machining on the different parts are very nearly the same before the parts come to the grinder. The parts are mounted for grinding upon a magnetic chuck. Regardless of the size of the parts, the total surface ground at each grinding tends to be about constant, even though one time there may be several small parts and at another only a few larger ones. Therefore, the grinding time for any one part gives a guide to the grinding time on other parts. If, however, it appears from observation that the variation in actual grinding time between parts is enough to take account of, it will be necessary to take studies on each group of similar parts.

Since the parts are put on the chuck in varying quantities, a complication exists, for although the proper grinding time to allow may have been determined, we do not know how to proportion the amount to individual parts because we have no information of the number of parts that may be ground at once.

Roughly, we know that this will be a function of the size of the parts as compared with the size of chuck, and of the surface exposed to the power available. With this information, a table might be prepared showing the number of parts of each kind which could be mounted at once on the chuck. But study shows that there is another factor.

Most parts must be surfaced by the grinders on both sides. At first glance it might seem that a lot of collars $\frac{1}{2}$ in. thick with a maximum variation of 0.010 in. could all be placed on the chuck up to its capacity, and

the grinding then begun with the wheel hitting upon the highest part only until it was reduced to the thickness of the next part. Then the grinding would proceed on two parts until the thickness of the third part was reached and so on until the high part had been reduced by half the amount of the total variation and then the parts could be turned over and treated similarly on the opposite side.

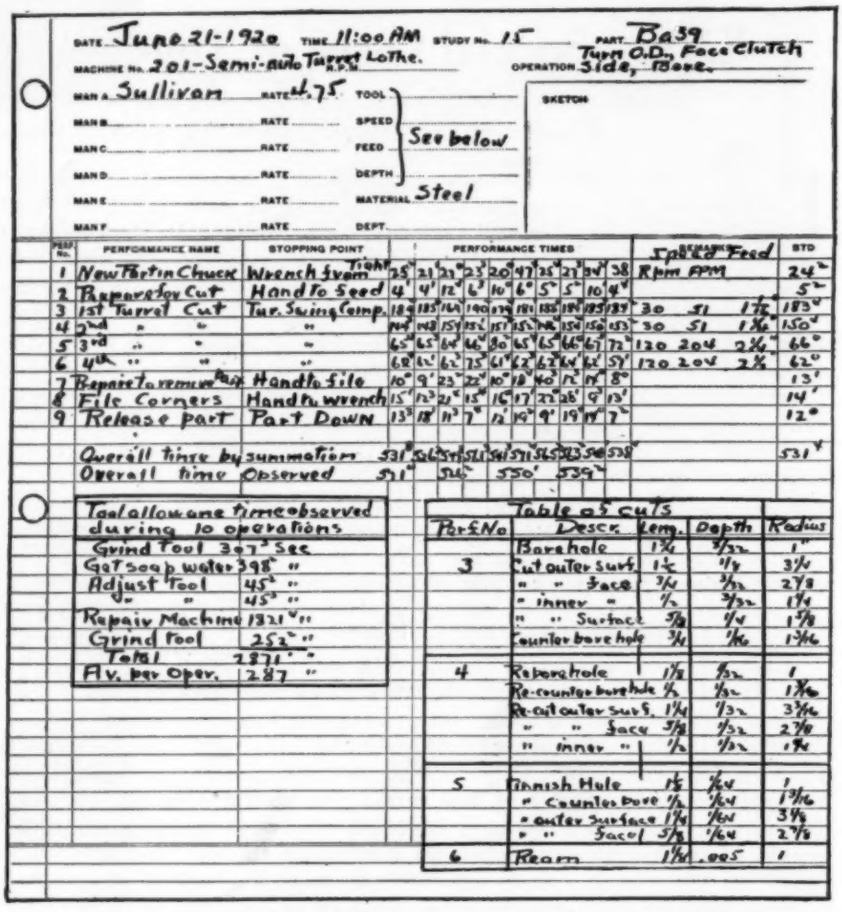
A little further thought shows that the result would be to grind those parts whose variation was less than half of the maximum on one side only, whereas it is required that all parts be ground on both sides. If the grinding, as above, were continued to three-fourths of the maximum variation from the first side, those parts whose variation was less than one-fourth would be ground on one side only. And so on. It is therefore the practice, before putting the parts on the chuck, to measure and group them in accordance with the amount of variation and run in one group only those parts with approximately the same amount of stock to be removed. The same thing holds true for many parts that are ground on surface grinders.

The situation is similar to that with the "cut off" and "recenter" operation on shafts. The basis of times here must be a single grinding, and we must determine the average number of parts going into a grinding. Accordingly we accumulate data upon this point by having the operator record the number of parts of each lot at a run. The averages obtained from this data are corrected in accordance with considerations of size of parts in connection with size of chuck, and surface of parts in connection with available power, to obtain a proper average run of each part.

Having secured this data we are next confronted with the fact that the most of our performances will be the disposition of our known average number of parts, and therefore we cannot make a single part the basis of any of the studies. The procedure will be to give one performance time column on the time analysis form to each lot and compile a "post-mortem" analysis from the detailed observations on a series of lots, obtained by continuous time observation.

The method of attacking time studies on chucking grinders differs from that used on surface grinders. Take for instance the operation "grind hole" on a gear. The gears are placed in the chuck one at a time and the hole ground to fit a standard gage. The grinding is cooled with soap water, therefore the expansion of the part with the heat of grinding is not a factor, and the only concern is the amount of stock to be removed, which, within the limits imposed upon the preceding boring operation does not vary enough to prevent a series of ten observations from being representative. We therefore proceed with the study in the same way that we would with a milling operation—by the part, rather than by the lot as we decided to do on the surface grinder. We can divide the operation up into performances, and readily obtain the standards, on such performances as "mounting" and "removing" by the methods already discussed. The number of performances, however, will include a varying number of "grinds" and "measures"; and these grinds will not be interchangeable, since the more the operator removes on the first grind the less there will be left for the second, and so on. It is necessary to determine in addition to the standard grinding time the standard number of "grinds" and of "measures."

This is done by continuous time observation, recording the time for each grind in its proper progressive order and never as some other grind if it actually was,


DATE June 21-1920 TIME 11:00 AM STUDY No. 15 PART Ba39
MACHINE No. 201-Semi-auto Turret Lathe. OPERATION Turn O.D., Face Clutch Side, Bore.
MAN A Sullivan RATE .75 TOOL
MAN B RATE SPEED
MAN C RATE FEED See below
MAN D RATE DEPTH
MAN E RATE MATERIAL Steel
MAN F RATE DEPT.
SKETCH

PERF. No.	PERFORMANCE NAME	STOPPING POINT	PERFORMANCE TIMES										REMARKS Speed Feed			STD
1	New Part in Chuck	Wrench from Tight	25"	21"	23"	23"	20"	47"	25"	21"	34"	38"	R.P.M.	F.P.M.		24"
2	Prepare for Cut	Hand to Feed	4"	9"	12"	6"	10"	6"	5"	5"	10"	4"				5"
3	1st Turret Cut	Tur. Swing Clamp.	185"	185"	169	190	179	191	185	184	185	187	30	51	1 7/32	183"
4	2nd " "	"	149	143	154	155	151	155	145	154	150	153	30	51	1 7/16	150"
5	3rd " "	"	65"	65"	64	46	80	65	65	66	67	72	120	204	2 1/4	66"
6	4th " "	"	68"	61"	63"	75"	61"	62"	62"	64	62"	59"	120	204	2 1/4	62"
7	Prepare to remove Burr	Hand to file	10"	9"	23"	22"	10"	18"	40"	12"	19"	8"				13"
8	File Corners	Hand to wrench	15"	13"	21"	15"	15"	17"	23"	26"	9"	13"				14"
9	Release part	Part Down	13"	18"	11"	7"	12"	15"	9"	19"	11"	7"				12"
	Overall time by summation		531"	526"	551"	541"	541"	571"	545"	543"	556"	538"				531"
	Overall time Observed		531"		546"		550'		539"							

Tool allowance time observed during 10 operations	
Grind Tool	307" Sec
Get Soap water	398" "
Adjust Tool	45" "
" "	45" "
Repair Machine	1321" "
Grind Tool	252" "
Total	2871" "
Av. per Oper.	287" "

Table of Cuts

Perf No	Descr.	Len.	Depth	Radius
	Bore hole	1 1/4	3/32	1"
3	Cut outer Surf.	1 1/2	1/4	3 1/4
	" " face	3/4	3/32	2 7/8
	" inner "	1/2	3/32	1 3/4
	" " Surface	5/8	1/4	1 5/8
	Counter bore hole	3/4	1/16	1 3/16
4	Re-bore hole	1 1/8	3/32	1
	Re-counter bore hole	3/4	3/32	1 3/16
	Re-cut outer surf.	1 1/4	3/32	3 3/16
	" " face	5/8	3/32	2 7/8
	" inner "	1/2	3/32	1 3/4
5	Finish Hole	1 5/8	1/64	1
	" Counter Bore	1/2	1/64	1 3/16
	" outer Surface	1/4	1/64	3 1/4
	" " face	5/8	1/64	2 7/8
6	Ream	1 1/4	.005	1

FIG. 115. TIME STUDY RECORD OF CLUTCH IN TURRET LATHE

say, fifth in order. We will then be able to compute the total grinding time in each operation which will run fairly uniform. We can tabulate the number of grinds for each operation of the ten observed, and fix upon a standard number of grinds.

In accordance with the average of our observations for each successive grind, we can apportion the total grinding time standard which we have set between first grind, second grind, third grind, etc. The number of grinds will give a key to the number of times which the gage should be fitted, and having standardized a measuring time we can supply one standard measuring time for each grind we have allowed. In this way we build up the total standard for the operation.

It is well also to record in the study the time spent in dressing the grinding wheel to give a key to the tool allowance.

Very small parts are commonly held in the hand in-

stead of being chucked for grinding. The time for picking up a group of parts in the left hand will have to be introduced into the standard through an average.

In Fig. 115 is shown the operation "turn O.D. face clutch side, bore," on part BA-37. It is a typical time study on operations of this class. The point of interest is the manner in which the cuts for several sides of the turret are isolated, and the table of cuts, which shows the detail of the cutting on each side. Note also the classified lost time below.

In the table of cuts the full detail of the set-up can be studied and the limiting cut picked out in each case. If the limiting cut is markedly below the other cuts, investigation can be made to determine if the cutting time can be reduced by transferring that particular tool to some other cut. The shapes into which all cutting tools are ground should be noted, sketched and studied in connection with the speed.

On some machines, it is necessary also to make continuous time studies of the hand feed-up time, and to set standards on that independently of the machine performance.

Since two or more of these machines are usually operated by one man, there is recurring lost time due to one machine running out while the other is being fed up. This lost time is perhaps best studied by an extended observation on time lost per hour from this cause, to arrive at a fair average. An average will have to be used because it is impossible to predict what parts will be worked on simultaneously and the lost time will of course vary with the varying relative time of the two operations in progress.

In setting rates, the following method will be found most satisfactory:

(1) Determine how many machines the operator should normally be expected to attend.

(2) Divide the basic rate per hour by this number; divide the operator's hourly rate by this number.

(3) In setting the rates, use in connection with the task per hour, instead of the whole basic rate, that portion of it which has, in (2) been assigned to each machine.

(4) Pay the operator at the piece rates for parts produced on each machine, up to the prescribed number of machines, and if any of the machines stand idle pay the operator the assigned fractions of his hourly rate for the idle machines concurrently with his piece rate earnings on the active machines.

(5) If the operator has occasion to use more machines than the standard number, pay him at the piece rate separately on each machine used. If the standard number of machines has been properly selected, the operator cannot concurrently run more than the standard number and still keep up his production on the standard number without great extra effort for which the piece rate on the extra machines will be no more than proper compensation.

If this method be followed out, the operator will always have an incentive to keep production at a maximum, and to work as many machines as he can, economically.

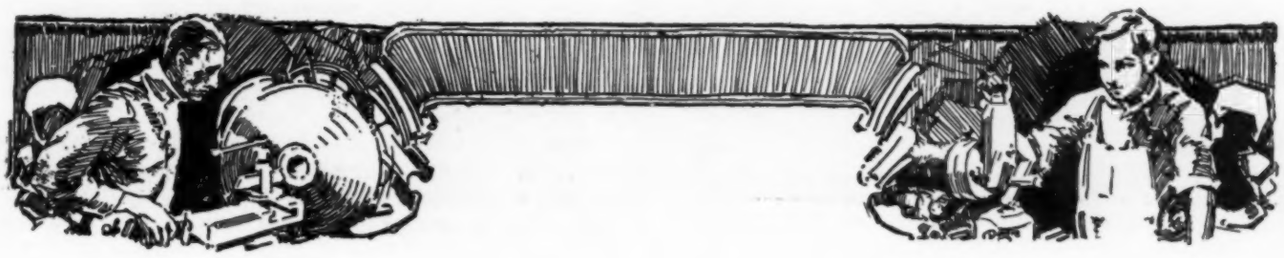
An example will perhaps make the above plan clearer. Let us assume that three machines per operator is decided to be the arrangement which will give best results. (The lost time per machine in combinations of 2's, 3's, etc., will give an indication of what the standard number should be.) The operator is paid 45 cents per hour for day work, and to his reasonable piece work earnings has been assigned the basic rate of 60 cents per hour. Since he cares for three machines he may be supposed to earn 15 cents per hour from each of the three to give the total flat rate of 45 cents per hour. Since his total piece rate earning is 60 cents per hour, 20 cents per hour is the basic rate for each machine. Suppose now that the "task per hour" in parts produced by one machine, was found to be 50. At $\frac{1}{5}$ of a cent for each part, he is able to earn the basic rate of 20 cents on one machine if he produces 50 parts in an hour. Assume that he uses the one machine only and lets the other two stand idle. He would be paid for the hour's work, 20 cents on one machine and 15 cents on the other two, or 50 cents instead of 45 cents. In point of fact he would make something over 50 cents through saving of the lost time allowances; but not as much as he could earn by operating two machines at once. Nor could he earn as much on two machines as he could on three, the full standard number.

Keeping Up Production

This is the incentive for keeping production up. If it became expedient to work four machines, or one above the standard number, there would be the possibility of a maximum 80 cents an hour; and yet this would only be approached, with the standard number of machines properly set, if he used enough extra exertion to offset the increased lost time which would not be allowed for, and to give the regular machines the proper attention to keep their production up to standard.

Sometimes it is necessary to make the time study cycle cover two parts instead of one, as for instance when certain holes are bored with the part in a jig, and certain others with the part mounted on bars run through housings and strapped to the table. The first part may have the jig holes bored first, and then will be removed from the jig and mounted on the housings for drilling. The next part will be drilled on the housings first, since they are already in position, and then put into the jig as the second stage of the operation. The third part will begin in the jig. Obviously, the proper method of study will be to make an artificial operation out of the machining on two successive parts, to give a complete cycle.

Admittedly, these few special considerations and problems of time study do not exhaust the subject. They merely indicate the scope and methods of approach. The next article will discuss in some detail the methods of time study and rate setting needed on automatic machines, a subject to which much thought has not been given.



Some Examples of Fixtures Used on Profiling Machines

With Suitable Fixtures, the Machines May Be Used for Many Different Operations—Two or More Operations May Be Performed At One Setting

BY J. M. HENRY

ON PAGE 256 of the *American Machinist*, Messrs. Dowd and Curtis very ably and entertainingly discuss the general construction of profiling machines and fixtures, with many practical suggestions as to their adaptation and use in manufacturing operations.

It is the present writer's belief that the above mentioned suggestions may be acceptably supplemented by a few "live" examples of profiling work together with illustrations showing the fixtures used and the manner of using them. To that end I have made a series of photographs of fixtures designed by the Pratt & Whitney Co. for attachment to its profiling machines.

The Scott & Williams Co., Laconia, N. H., manufacture knitting machines, and in this class of machinery, perhaps to a greater extent than in most other classes, there are used many "cams" and "fingers" of irregular shape that would be difficult if not impossible to produce by other means. In Fig. 1 may be seen a few of the parts of such machines manufactured by this company and from the picture a general idea may be gained of the nature of the work.

In some of the parts shown the entire contour is finished at one setting, thus necessitating a fixture in which the clamping devices may be loosened, reset and tightened progressively as the operation proceeds.

One of the simplest of such fixtures is shown in Fig. 2, which is designed to hold the part *A* in Fig. 1. In this case but one clamp is used at a time and the machine must be stopped while the clamps are changed. The work is located upon the block by studs or dowels, and a clamp, having its holding end machined to conform to the shape of the piece, holds it down by direct pressure. After finishing a little more than one-half of the contour, the clamp is loosened and moved out of the way while the other one is brought forward and tightened upon the work to hold it for the remainder of the operation.

An internal milling operation is shown in Fig. 3 where a portion of the contour of the cam ring *B*, Fig. 1,

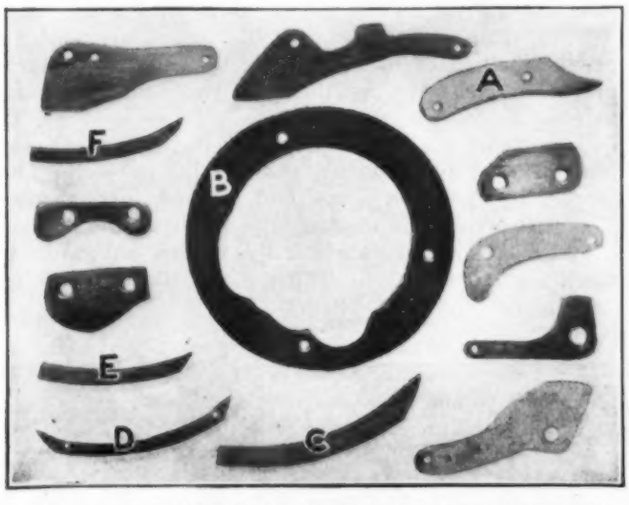


FIG. 1. KNITTING MACHINE PARTS TO BE FINISHED BY PROFILING

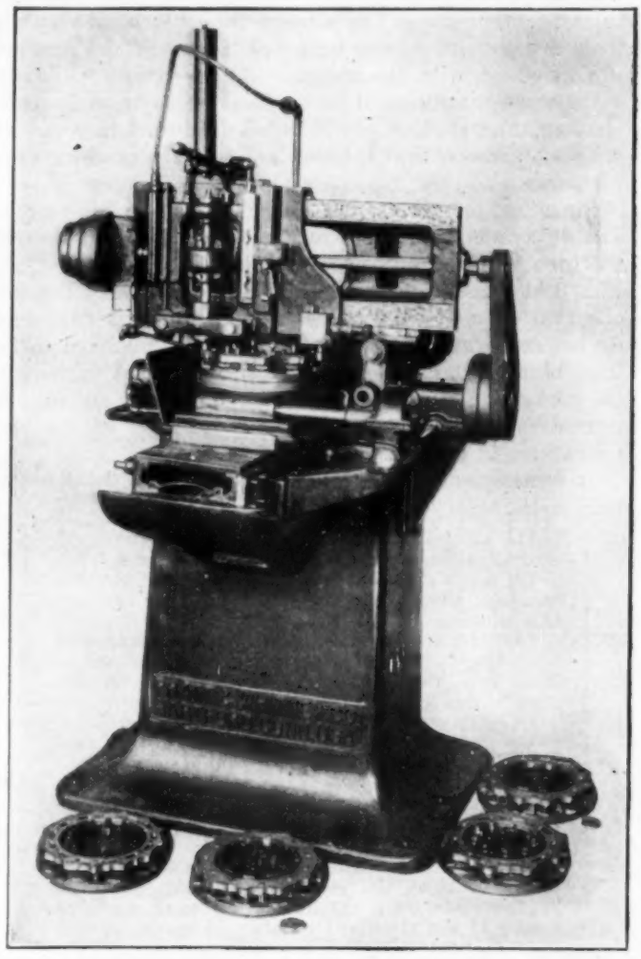
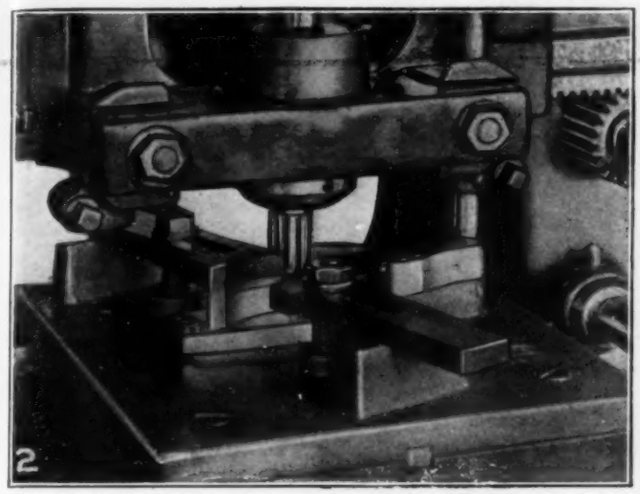


FIG. 4. MACHINE FOR CONTINUOUS MILLING UPON ROTATING TABLE

is to be milled. In this case a single yoke-strap is used that spans the work and holds it by direct pressure. Dowels in the boss which supports the work locate the latter in correct position and prevent lateral movement.

In Figs. 4 and 5 may be seen a device for continuous milling. A rotating table is driven through spur and worm gearing from the three-step cone pulley keyed to an extension of the main drive shaft of the machine; the three steps providing for varying speeds of the table to accommodate different pieces, some of which may require more time to set than others, or to make allowance for different operators who may possess varying degrees of dexterity in manipulating the work.



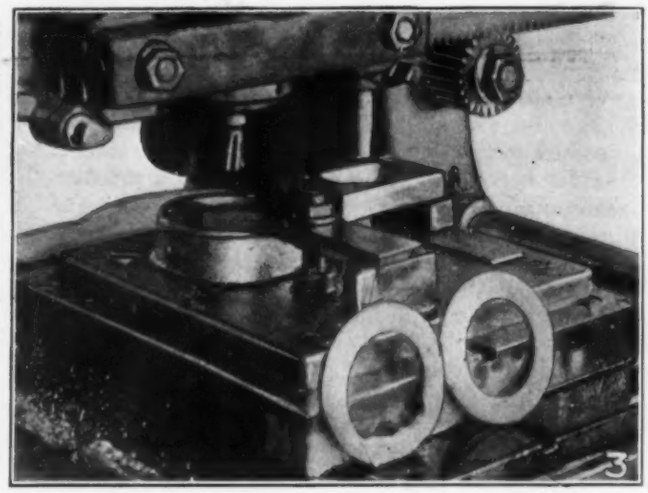
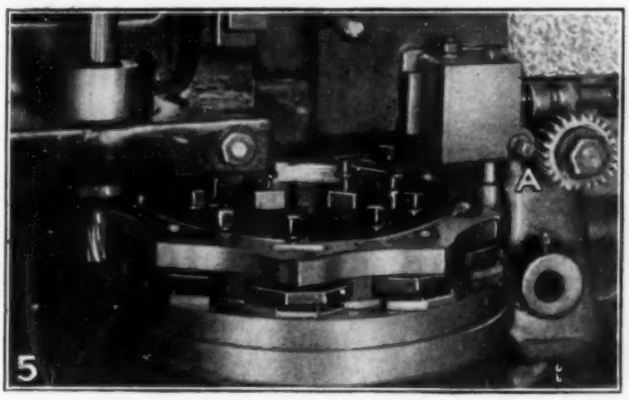


FIG. 2. HOLDING A PIECE PROGRESSIVELY FOR MILLING THE ENTIRE CONTOUR. FIG. 3. YOKE STRAP FOR HOLDING A PIECE WHILE MILLING INTERNAL CONTOUR

The baseplate of each fixture fastens to the table with suitable screws and dowels, so that it is but the work of a few moments to change from one job to another. The clamps and master plate for each fixture are permanently a part of it, so that no resetting is required when the change is made.

In this device the master plate is directly above the work and revolves with it instead of being mounted upon a second table as in many forms of cam cutting machines. The guide pin, at *A* in Fig. 5, is so located that it bears upon the master plate at a point opposite to the cutter and is adjustably mounted so that small adjustments of position may be made in setting up or as the work proceeds. A micrometer screw to the right enables the operator to change the position of the pin a definite amount. Similar fixtures may be seen on the floor at the base of the machine in Fig. 4.

A reciprocating fixture is shown in Fig. 6 upon which



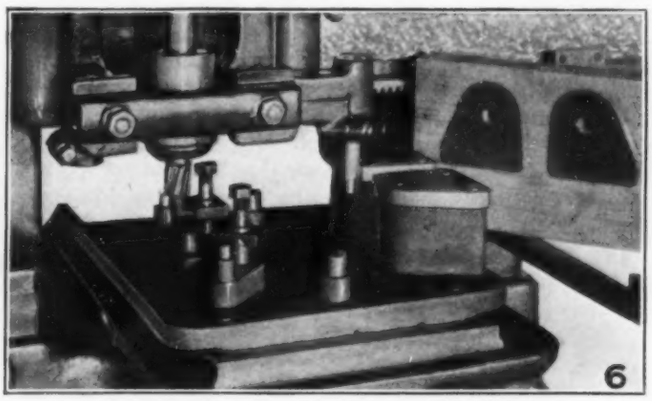
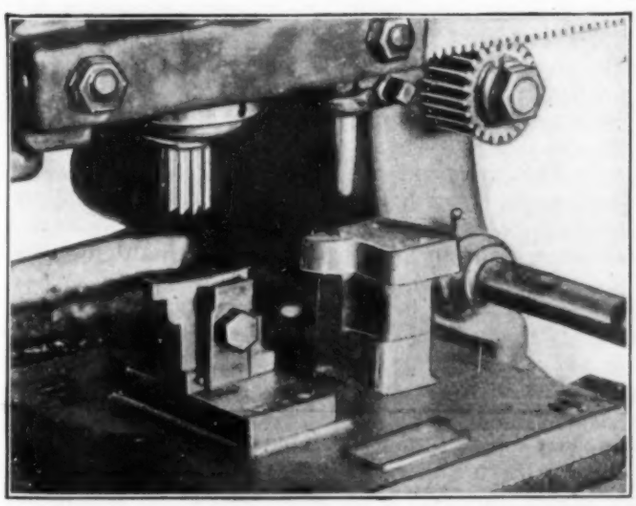


FIG. 5. A CLOSER VIEW OF THE CONTINUANCE MILLING FIXTURE. FIG. 6. PROFILING TWO PIECES AT ONE SETTING



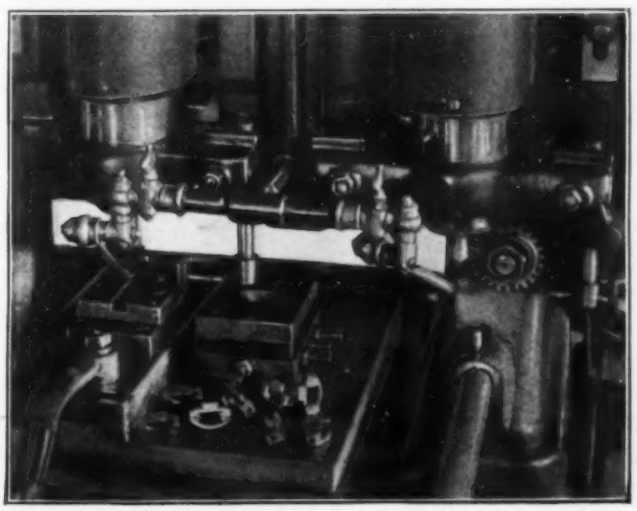


FIG. 7. A SIMPLE HOLDING DEVICE. FIG. 9. THE FIXTURE ON THE DOUBLE-SPINDLE MACHINE

work on two different pieces is carried forward at the same time. Two master plates are provided and but one guide pin and cutter are used. The pieces are right- and left-hand and slightly different in contour. Both are finished complete at one setting; thus one machine and fixture is made to serve where two would ordinarily be required.

Fig. 7 shows a simple form of clamp for holding the "cam" *C*, Fig. 1, for milling the end only. This is probably about the simplest fixture that could be made for the purpose, the block and clamp being formed to fit the contour of the piece. Parts *D*, *E* and *F* in Fig. 1 are held by similar devices.

The profiling operation has an important application in the manufacture of gun sights and some of the tools used are here considered. Much of this work involves two cuts—one for roughing and one for finishing—and this may be accomplished in either of two ways; a double-spindle machine may be used, moving the entire head over to bring into action a second cutter and guide pin, or, on the single-spindle machine, the tapered guide pin may be raised a definite amount and the slide lowered to correspond, thus allowing the same cutter to come a trifle nearer the work.

The double-spindle machine in Fig. 8 is equipped with a holding fixture, similar to a drill press vise, in which the work is clamped between a fixed and a movable jaw by a single movement of a cam lever, thus reducing the time of unloading and reloading to a minimum. False jaws to this vise provide for holding a variety of work.

It will be noted in this fixture that the master plate is not permanently located on the base, but is doweled to a block that is susceptible to movement in any direction by means of opposed screws and setscrews passing through and bearing against a projection which depends within a rectangular recess in the supporting boss. By this means the toolmaker has an easy method of securing correct relationship between the master and the work in the initial set-up. By taking a cut and checking up the work he may know the extent and direction of the error and may adjust the adapter accordingly. When the correct position is finally determined the master plate is permanently located by dowels. Fig. 9 shows this fixture in greater detail, together with some of the parts to which it is adapted.

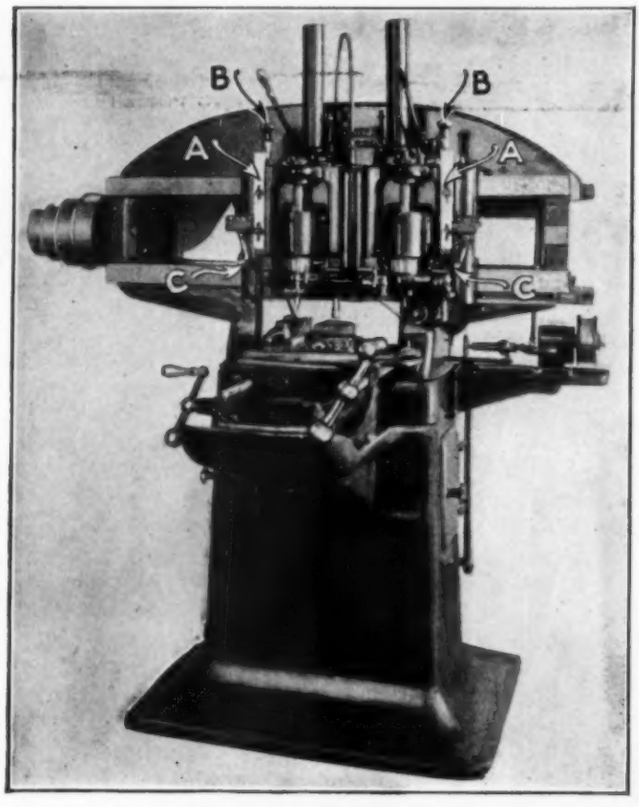


FIG. 8. DOUBLE-SPINDLE MACHINE WITH FIXTURE FOR MORE THAN ONE OPERATION

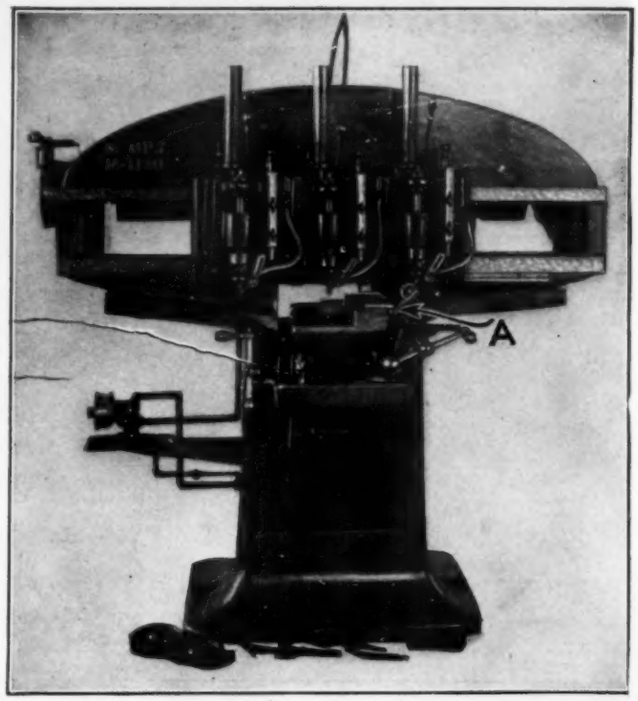


FIG. 10. PERFORMING TWO OR MORE OPERATIONS AT ONE SETTING

Upon accurate work, in which class all gun sight work may be safely included, close vertical adjustment of the profiling machine is a vital necessity because of the fact that the guide pin, and in many cases the cutter, is tapered and any variation of height immediately affects the sizes of the product.

To secure this accuracy the two stop plates *A-A*, Fig. 8, are so attached to their respective slides that by loosening the clamping screws they may be moved up or down a definite amount, the movement being gaged by means of a micrometer screw *B* in the upper end of each. A notch in the side of each stop plate engages an index pin controlled by the handles *C* and held in engagement by means of a coil spring.

By moving the respective handle to one side the index pin is withdrawn and the slide raised out of the way. When again bringing it into action it is lowered by means of its operating lever until the index pin snaps into place, assuring the operator that the position of the slide is correct.

Figs. 10 and 11 show, comprehensively and in detail, a multiple spindle machine that is set up for performing several operations at one setting and upon the same class of work—gun sights. The work is held, as in the previously described fixture, by a quick acting vise somewhat differently located.

To this fixture there are two, and may be more, master plates, doweled to a slide capable of transverse movement with respect to the base of the fixture. Its

position is determined by means of a locking bar rigidly attached to its under side, in which bar there are two or more locating notches to engage a spring controlled index pin that may be withdrawn by means of the handle *A*.

The cutters are of different shapes, and are set to different depths to perform operations of contour milling, recessing, internal grooving, etc. As each is provided with its own guide pin and master plate they are virtually independent one from another. The operator has only to see that the proper master plate is used in conjunction with its respective part.

An ingenious device for directing the flow of oil to the cutter is used in connection with this job. It consists of a metal spout (one for each cutter) a part of which is made in the form of a sphere and held between two clamping plates that are recessed to correspond. The device thus forms a ball and socket joint which can be instantly turned in any direction within its range and the adjustability of which is supplemented by making the shank of the socket in the form of a slotted yoke that can be clamped in whatever position may be required.

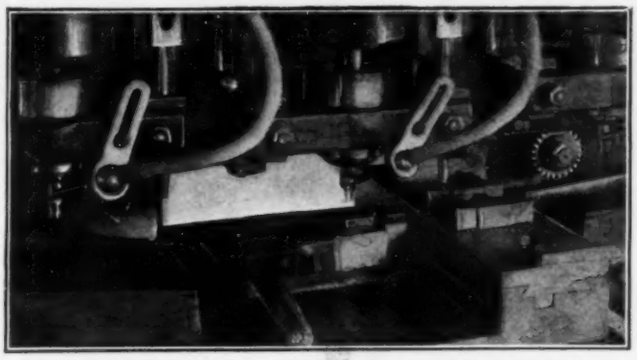


FIG. 11. CLOSER VIEW OF FIXTURE, SHOWING OIL SPOUTS

Notes on Worm-Thread Formulas

BY P. A. FREDERICKS

Most handbooks give formulas and lists of sizes for worm threads with thread dimensions measured on an axial section; that is, in a plane through the lines *AA*, Fig. 1. A few qualify this treatment by the statement, usually in a minor paragraph, that for helix angles of 15 deg. or more the thread parts should be measured at right-angles to the helix; that is, in a plane through the line *BB*. In this case the normal pitch or P_n equals P times the cosine of the helix angle, and becomes the basis for determining the size of the threading tool point, measuring wires, etc. Also, the thread angle must be 29 deg. as measured in the plane through *BB*. It is, of course, apparent that if the depth were not changed in accordance with the top and bottom width, then the angle would not remain 29 degrees.

This all becomes very confusing, and is really incorrect, leading to very definite errors. Assume that a 29-deg. worm thread of 1 in. pitch is to be cut on a diameter which gives a helix angle of 8 deg. As this angle is considerably below the 15-deg. limit mentioned in the handbooks, we figure our thread sizes and the size of the measuring wires from the formulas based on P, or read them from the tables usually accompanying the formulas.

Consider the three factors, Fig. 2, which will be of most importance in cutting the thread; namely, W equals the width of the threading tool at the end, D equals the depth and X equals the diameter of the measuring wire. We find, either by formulas or from tables, the following values for the case mentioned:

$W = 0.310$ in. $D = 0.6866$ in. $X = 0.5149$ in.

If we are going to cut the thread in a lathe, we set the threading tool square and go ahead until we get

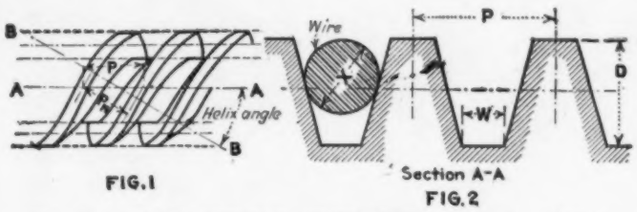


FIG. 1. WORM THREAD ELEMENTS. FIG. 2. AXIAL SECTION OF THREAD

down to the proper depth, which has been given as 0.6866 in. Then we lay the wire in, expecting, of course, that it will come flush with the top of the thread, as in Fig. 3. But does it? It does not. After eliminating everything else, we finally discover that while our threading tool is square with the axis, our wire lies 8 deg. from square; and it dawns upon us that this might be the reason for our trouble. So we figure it out, and after considerable creaking of rusty mathematics find that our 29-deg. angle is only 28 deg. 42 min. where the wire rests. Due to this, our wire will extend 0.0089 in. outside of the top of the thread, instead of flush as we had expected, see Fig. 4.

Considering the case a trifle further, we conclude that, due to several disturbing factors, the distance 0.0089 in. isn't quite correct either. But our mathematics and our patience both being exhausted, we decide to fit the screw to the nut and let it go at that, disregarding the wire sizes and proceeding on the old method of cutting and trying.

The next time we set up the job we think that we shall profit by our last experience, and we set our threading tool tilted sidewise to the value of the helix angle, regardless of the handbook. This appears to work better; the wire comes flush as it should, and all goes well until we try the screw in the nut, when we find end play. We determine to chase things down; and eventually discover that our threading tool is cutting too wide a space, leaving the remaining thread too thin. By this time our ire is fully aroused, so we sharpen a new

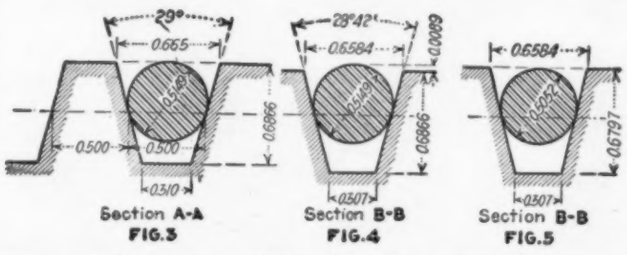


FIG. 3. HANDBOOK DIMENSIONS OF THREAD. FIG. 4. ACTUAL CONDITIONS OBTAINED. FIG. 5. PROPER DIMENSIONS OF THREAD

pencil and depart to a quiet spot with our handbooks and plenty of paper.

We decide to see what happens if we disregard the 15-deg. limit set by the handbooks and figure our thread dimensions normal to the thread, or in the plane pre-

viously mentioned through the line *BB*, Fig. 1, using the handbook rules applying to screws with angles of 15 deg. or more. This gives us the result shown in Fig. 5. There is nothing wrong with this layout, and we can cut this thread very nicely with the tool tilted to the side to the amount of the helix angle; but it does not match the handbook data for threads of 8-deg. helix angle, nor does the size of wire match the size given in the handbooks.

The Error in the Handbooks

Now the trouble is, of course, that the helix angle on the thread becomes troublesome at far less than the 15 deg. which the handbooks mention, so that the wire sizes which are so carefully tabulated in the handbooks are wrong for every screw, except one with a zero helix angle. The condition shown in Fig. 3, which shows the way things should come out according to the handbooks, is impossible except for a zero helix angle, giving the equivalent of a circular rack, because the measuring wire is bound to stand at an angle corresponding to the helix angle. This angle, while neglected in the handbook tables up to 15 deg., is sufficient to cause trouble when working on screws with helix angles far smaller.

Although a worm thread has been taken as an illustration, the same objection to handbook data applies to all types of threads. The data are often obsolete relics of the time when screws were mainly confined to fine leads having 2 or 3 deg. helix angle, at most. At that time, the tables were near enough, and probably closer than the work would be made.

Will the makers of quick-pitch hobs, worms and screws not take us into their confidence, and let us know what we would really get if we were to order a worm such as specified in the example just cited? Would it not be a good thing to revise the handbooks in conformity with their standards, or at least to caution the users as to the facts of the case?

Some Operations in Roller Bearing Manufacture

Various Kinds of Grinding Machines and Grinding Operations—Utilizing an Internal Grinding Machine on Outside Work

SPECIAL CORRESPONDENCE

THE manufacture of roller bearings consists for the most part of a series of grinding operations, as can be seen from the accompanying illustrations taken in the plant of the Hart Roller Bearing Co., Orange, N. J. An exception is shown in Fig. 1, where the cages are being machined on a Cleveland automatic preparatory to the grinding operations which follow hardening. This view gives a good idea of the tooling used.

One of the simpler grinding operations is shown in Fig. 2 where comparatively small roller thrust plates are being surfaced on a Blanchard machine. In Fig. 3 some of the rollers, which have previously been turned and bored on automatics, are being ground on a Sanford centerless grinding machine. The rollers are automatically fed into the machine from the magazine at *A* and after passing the grinding wheel drop into the box as shown.

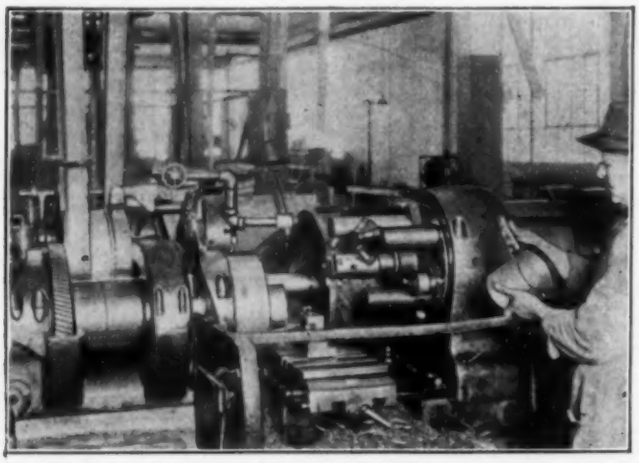


FIG. 1. MACHINING SMALL BEARING CAGES PREPARATORY TO THE GRINDING OPERATION

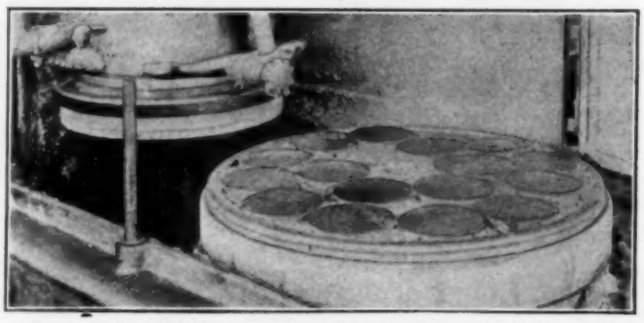


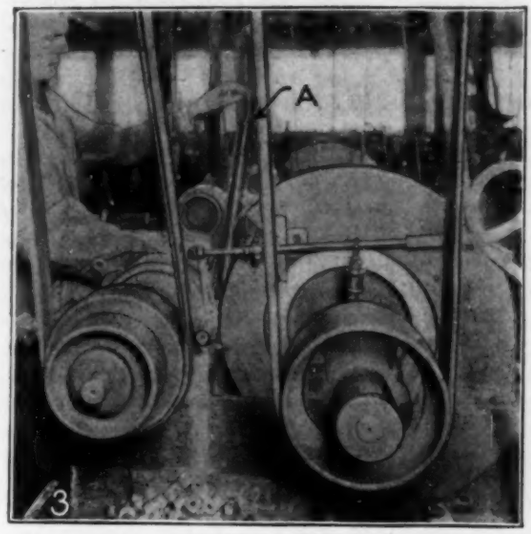
FIG. 2. GRINDING THRUST PLATES (THE WORK HELD ON A MAGNETIC CHUCK)

The internal grinding of some of the smaller races is done on the Bryant chucking grinding machine shown in Fig. 4, a number of finished races being shown on the bench. Figs. 5 and 6 show some considerably larger roller races. The first view shows the grinding of the ends on Blanchard machines while Fig. 6 is an interesting application of a Heald internal grinding machine to outside work. This arrangement is very convenient and enables a large variety of work to be handled without putting in special equipment that would be used only occasionally.

Many Sizes Manufactured

Some idea of the variety of roller bearings manufactured can be had from Figs. 7 and 8. Fig. 7 shows seven sizes of roller races nested together and indicates that micrometers of all sizes are available for their measurement.

A large completed bearing is shown in Fig. 8 together with a number of roller cages of various sizes. This illustration also shows a large Vernier caliper, both Verniers and micrometers being used for insuring accuracy on large-size bearings.



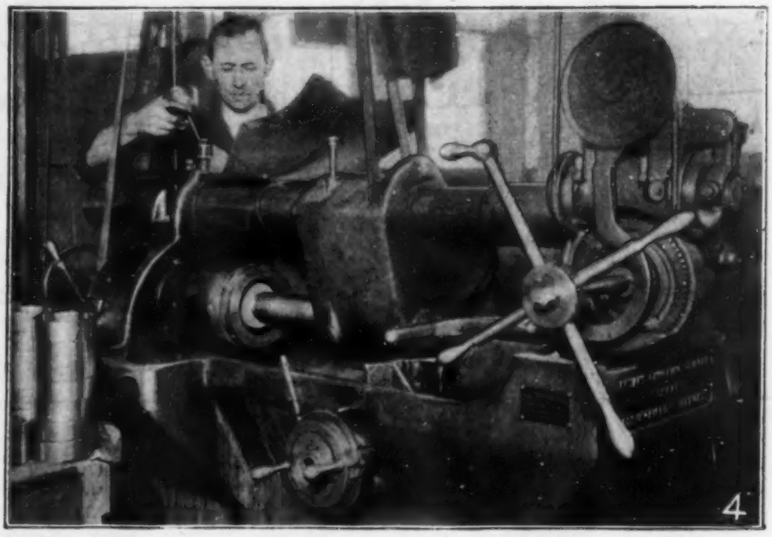
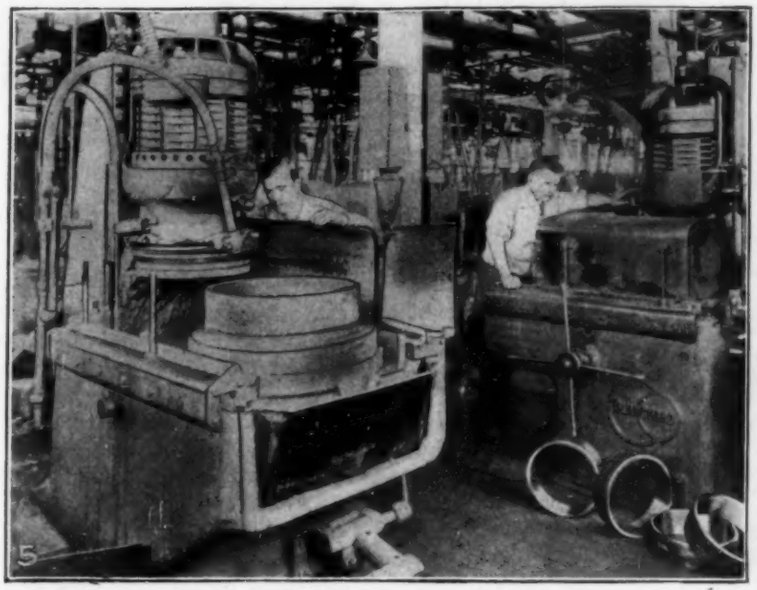


FIG. 3. GRINDING ROLLERS, USING MAGAZINE FEED. FIG. 4. INTERNAL GRINDING OF ROLLER RACES



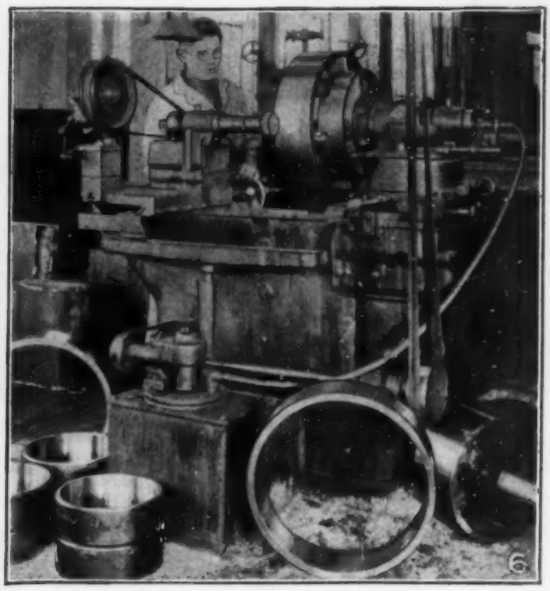


FIG. 5. GRINDING THE ENDS OF LARGE RACES. FIG. 6. UTILIZING AN INTERNAL GRINDING MACHINE

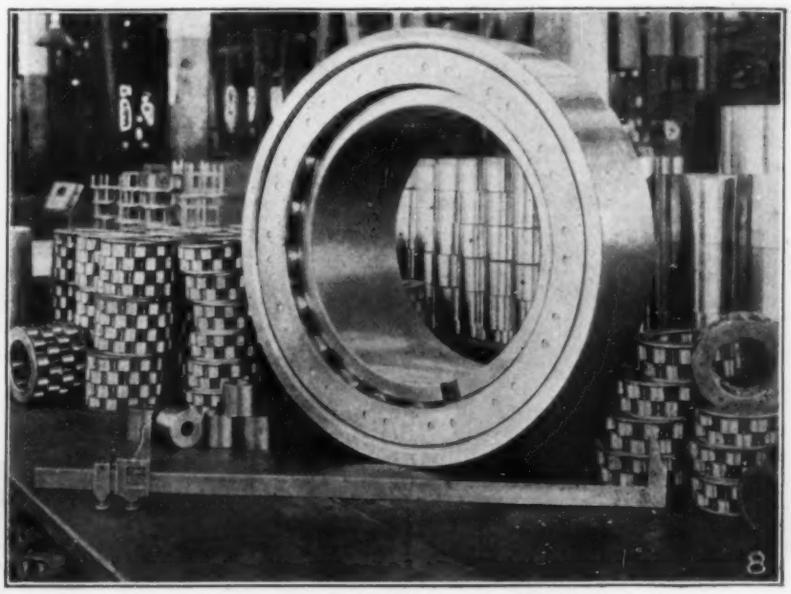


FIG. 7. SEVEN SIZES OF ROLLER RACES. FIG. 8. A LARGE ROLLER BEARING

A Good Example of Push Broaching

The Use of Shorter Broaches Which Are Easy to Make and to Harden—Details of The Broaches and How They Are Cut on a Gear Shaper

SPECIAL CORRESPONDENCE

IT IS PROBABLY safe to say that 90 per cent or more of the broaching done in manufacturing is performed with the "pull" broaching machines and long broaches. These have been developed by persistent effort to a point where broaching has become a standard operation just as has milling and grinding.

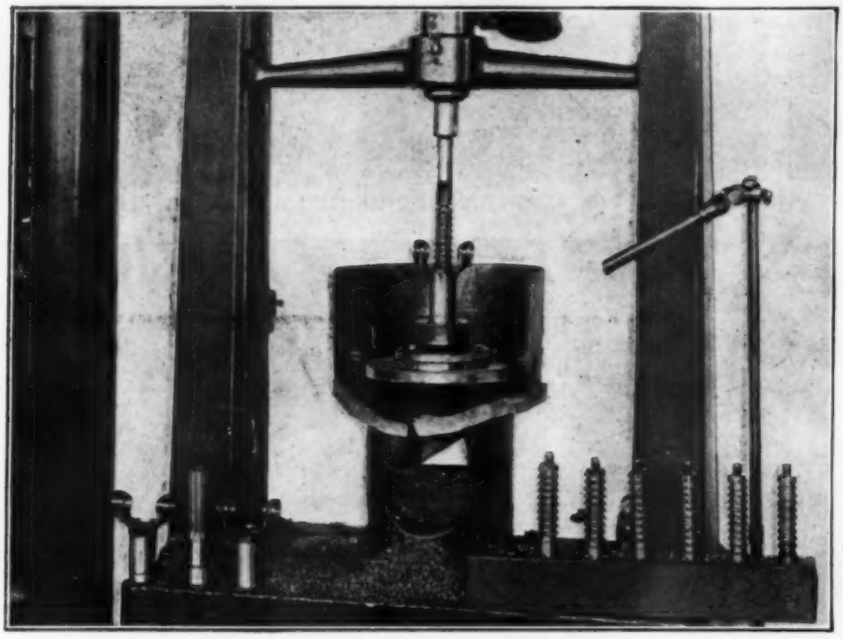


FIG. 1. BROACHING A DRIVE YOKE

But here and there we find shops which have come to believe, that for their work at least, the "push" broach has the best of the argument. Such a shop is that of the Universal Drive Shaft Co., 6200 Carnegie Ave., Cleveland, Ohio. The man responsible for the results obtained is F. W. Peters, one of the firm, and he is securing exceptionally good splined holes 5 inches long in a driving yoke, with only 35 inches of broach, divided among seven short broaches.

The illustration, Fig. 1, shows the broaches and the piece which is broached as well as the members of a coupling. The seven broaches are short, the total length being about 7 in. each. The first tooth of the series of each broach (after the first) is the same size as the preceding broach, so as to insure easy starting.

The broaches are cut on a Fellows gear shaper with special stubbed teeth of a shorter length than usual. The spline, or piece which enters the yoke, is also generated in the same way. This form of spline centers itself so that all the teeth bear evenly, which is not always the case when a straight sided tooth is used. Generating both the broach and the piece which fits the hole makes it possible to secure a remarkably good fit the entire length of the piece.

The short length of the broaches eliminate the difficulty of breaking, as they spring very little, so that it is not at all necessary to either straighten or grind the teeth. This makes it easier for a shop to make its own broaches and makes it possible to experiment with broaching possibilities at a lower cost.

It has been found that the teeth of the first two or three broaches can be given a cut of 0.004 in. per tooth,

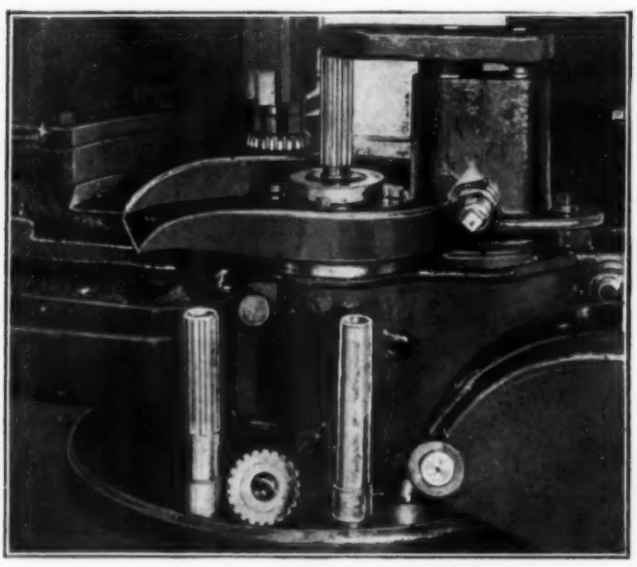


FIG. 3. HOW THEY ARE MADE

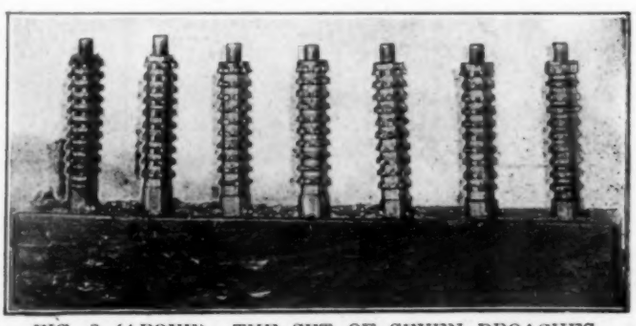


FIG. 2 (ABOVE). THE SET OF SEVEN BROACHES.
FIG. 4 (BELOW). THE YOKES WHICH ARE BROACHED

but that the remaining or finishing broaches do a better job if the cut is reduced to 0.003 in. per tooth. The teeth are undercut 10 deg. and have a top or cutting rake of 3 deg. so that they roll a chip off with a clean cut. The spacing also gives ample room for chips.

The machine used is a Lucas power press which has been modified so as to give a faster power movement and a quick return. This enables an operator to finish the hole complete in two minutes, giving him ample time to handle the work and the seven broaches, one after the other. The work is remarkably smooth and uniform. This coupled with the low cost of broaches and equipment, makes it well worth careful consideration.

The broaches are shown more in detail in Fig. 2. It will be noted the lower end is plain where it enters the hole as a guide and that the upper end has a pilot which it fits into the ram of the press. The first broach is on the right and the finishing broach on the left.

Fig. 3 shows how both the broaches and the splined connections are generated. It also shows the special shape of the stub tooth used.

The splined units of the drive shaft are shown in Fig. 4.

Reminiscences of an Old-Time Machinist

By R. Thomas Huntington

In 1867 or '68 a machine shop in Philadelphia that made a specialty of coining presses received from either the Chilean or the Peruvian government an order for a number of such presses to be made from an alloy similar to that of which the howitzers on the U. S. Naval vessels were made. I suppose the officials of that far-away country had seen and admired the shining guns, and the idea of having their new mint equipped with such bright and shiny machinery appealed to them.

At any rate the government aforesaid entered into a contract with the company not only to furnish the presses but to send with the consignment six men capable of assembling the machinery and setting it running. The government undertook to pay these six men five dollars a day each, in gold coin, and bear all expenses from the day they left Philadelphia until they returned.

Though I had no hand in making these presses I was kept informed by a friend who was on the job. There was, of course, no difficulty in pouring the castings, but especial care in finishing the molds and in the pouring was necessary in order to avoid having blow holes or other imperfections that would mar the surfaces and spoil the general appearance of the otherwise highly polished machine.

Even with the utmost precaution such spots would occasionally appear, and in such cases the company adopted the expedient of cutting out a portion of the surface surrounding the bad spot (including, of course, the bad spot itself) and setting in a patch. In order to make certain that the patch would match the metal of the frame in color and appearance, numerous impressions, round, square and rectangular would be made in each mold and poured from the same batch of metal at the same time that the main casting was made; each set of patches so made being kept with the main casting from that mold and used as necessary.

To insert a patch the metal of the frame would be cut out with chisel and hammer to a depth of ¼ in. or more, depending upon the size and location of the patch, with the sides of the cavity carefully squared and the edges sharp. The patches would then be carefully fitted and held in place by countersunk head screws made without slots and with heads long enough to allow the screws to be set up tightly and then cut off flush.

The screws were, of course, of the same material, and when a patch had been properly set, the screw heads cut off, the edges hammered down all around, and the whole surface polished, it would be difficult, even for the man who put it in, to distinguish the patch from the surrounding metal.

Polishing the frames was no easy job. Practically every bit of the surface must be finished by hand with chisel, file and emery cloth, but to "get off the thickest of it" a swing frame was made, not unlike the hand grinding devices of today in principle, but much more cumbersome owing to the necessity for a belt drive. Polishing wheels made with centers of wood covered with leather were fitted to the swing frames, and these clumsy devices saved a great deal of hand work on the broad exposed surfaces but there still remained many corners inaccessible to the wheel and the finishing of a press frame was a tedious and long-lasting job at best.

Eventually the machines were completed and the consignment left Philadelphia with the six highly favored individuals, who were to accompany the shipment, on board the same vessel.

Tipperary is not located on the west coast of South America, so far as I am aware, but the destination of those presses was nevertheless a "long, long way." There was no Panama Canal to shorten the distance,

THE AFTERMATH WHERE THERE IS NO EIGHTEENTH AMENDMENT

and the long trip around the Horn in a "wind-jammer" was tedious and monotonous. Also there may have been no Eighteenth Amendment to the Chilean or Peruvian constitution (whichever it was) in force at that time.

Anyway the morning after the landing found all six of the special envoys in the calaboose, where they remained for several weeks, despite the frantic endeavors of the American Counsul and other interested parties to effect their release.

Though the government of the South American country sought to evade a portion of its contract, it was unable to do so (possibly through fear of the very guns whose brightness first attracted its attention) and in the end was not only obliged to furnish free board and lodging during the period of incarceration, but to pay the men five dollars a day in gold for staying in jail.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Device for Generating an Oval

By R. J. DePuy

We had to make a number of each of the pieces shown in Fig. 1. It was necessary to have the pieces of each kind interchangeable and one was required to be a

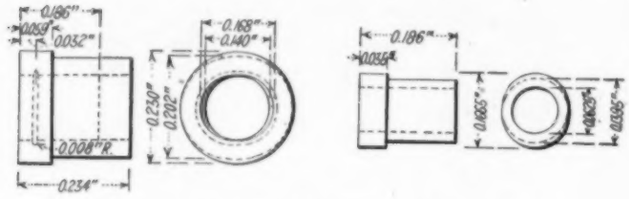


FIG. 1. OVAL PIECES TO BE PRODUCED

sliding fit inside the other. We used the apparatus shown in Fig. 2 in preference to the cam method, which would have necessitated a different cam for each piece.

Referring to Fig. 2, gear *A* is forced on the body of a small chuck, which is then placed in the spindle of the lathe and the gear held tightly by two bolts through the small faceplate. Gear *B* is keyed to shaft *C*, and meshes with gear *A*, the ratio being 1:2. Shaft *C*, which is of tool steel and hardened, passes through the bracket *D*, the latter being firmly bolted to the wing of of the carriage, and has an eccentricity of 0.014 in. at *E*. A connecting rod *F* between the eccentric and a pin in the angle plate *G*, which is in turn bolted to the cross-slide, transmits a reciprocating movement to the latter. A wire rope is fastened to the under side of the cross-slide and passes over a roller to a suitable weight, to keep an even tension on all parts.

When the lathe is started, gear *A* turns gear *B*, which rotates the shaft *C*, causing the eccentric to move the cross-slide back and forth twice to each revolution of the lathe spindle, thus producing flats on opposite sides of the work. When turning the round parts the gears *A* and *B* were thrown out of mesh by moving the carriage

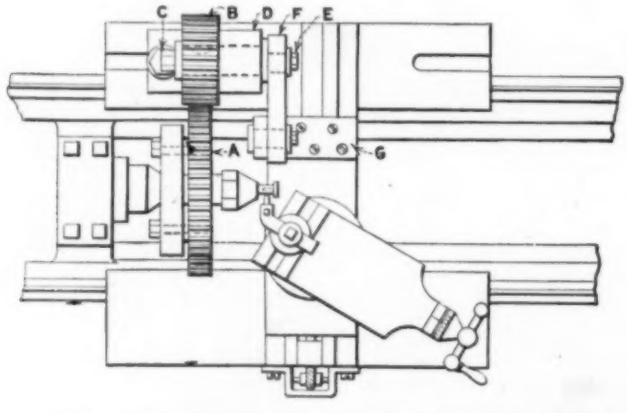


FIG. 2. THE DEVICE FOR GENERATING THE OVAL

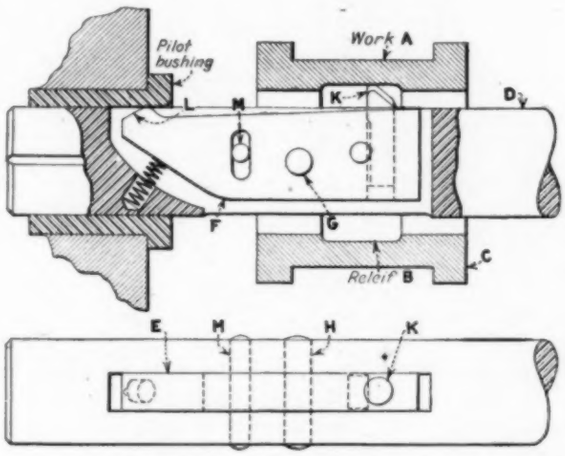
Boring Bar for Cutting an Inside Relief

By Gene Phelps

Cutting an inside relief in a piece of work generally requires considerable care and many methods have been used for producing this type of cut. The most common method used is by means of a solid tool held in a toolblock, set to the correct depth by hand and then fed through the work until the required length is obtained.

Recently the writer designed a simple relieving bar which is shown in the illustration. The bar is automatic in its operation and after setting the tool to cut to the correct depth, the work produced is uniform.

The work *A* has a relief *B* to be cut as shown, the relief being located from the face *C*. The bar *D* has a slot cut at *E* into which fits a tool holder *F*, fulcrumed at *G* by means of a pin *H*. The cutting tool *K* is held at one end as shown and on the other end the toolholder beveled at *L*. As the bar is fed through the work it enters the pilot bushing and the beveled end *L* of the



BORING BAR FOR CUTTING AN INSIDE RELIEF

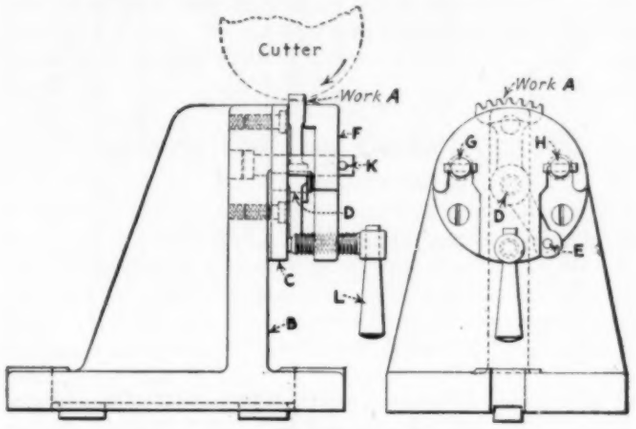
holder strikes the pilot bushing, which forces the tool *K* into the work to the required depth. The length of the bushing can be the same as the length of the relief if desired, but if that is not practicable a feed stop can be used for the correct length of cut. When the bar is withdrawn from the work the spring shown throws the holder out so that the tool *K* goes inside the previously bored hole. The pin *M* governs this movement so that the holder does not project too far.

Rapid Clamping Milling Fixture

By Frank Waldo

There are a number of methods of clamping used on various devices, but a milling fixture often requires something special in order that the operator's hands may not approach too closely to the cutter. An example of a clamp that can be used for milling work without

endangering the operator is shown in the illustration. The work *A* is a lever at the end of which a gear sector is to be milled. The work has been previously machined on the sides and has holes drilled at *D* and *E*. The work is set up for this operation on the angle-plate fixture *B*, on which the hardened plate *C* is fastened. The work locates on studs at *D* and *E* in such a position that the portion to be cut stands vertically. The clamp *F* is made so that it rests on two studs at *G* and *H* and bears against the work very close to the point where the cutter is operating. The clamp is slotted so that it drops down



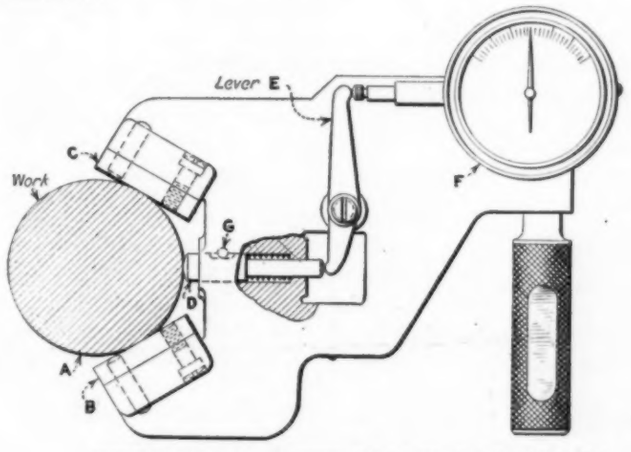
RAPID CLAMPING FIXTURE

over the two pins mentioned and the lever *L* operates a screw which bears against the hardened plate *C*. The result of this pressure is taken by the pins *K* which act somewhat in the nature of a hinge. In removing the clamp it is only necessary to loosen the handle by giving it a turn and pull the entire clamp off from the studs when the work will be found easily removable. Various applications to this clamp will be found useful where work is to be held in such a position that the ordinary type of clamp cannot be used.

Indicator Gage for Checking Diameters

By C. W. Frank

The quick-acting gage for checking the diameter of work shown in the illustration, can be used to advantage over a micrometer when a large amount of work is to be checked. In place of gaging the work across the diameter this gage has three points, two of which are set and the third, a plunger, which acts on the dial indicator.



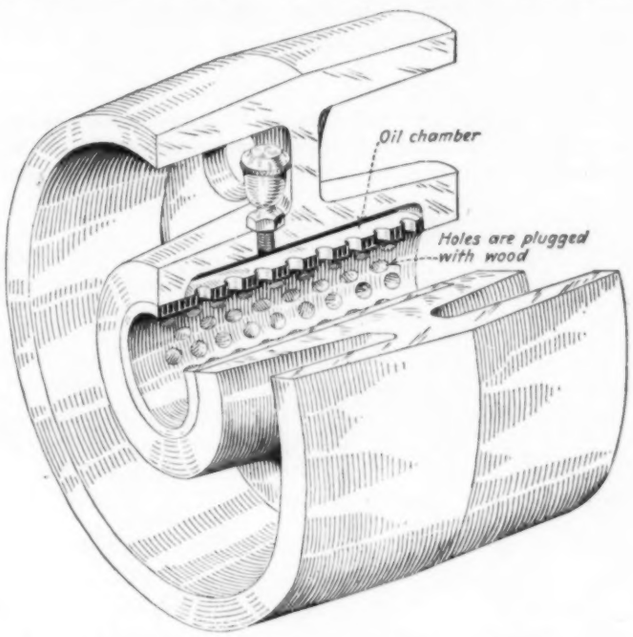
INDICATOR GAGE FOR CHECKING DIAMETERS

The blocks *B* and *C*, which strike the work *A*, are set at 30 deg. with the center line of the work. The plunger *D* strikes the work on the center line and transmits its movement through the arm *E* to the dial indicator at *F*. It will be noted that the ratio of the arm is two to one, which thus gives a one to one reading with the variation of the diameter of the work. If the blocks were to be set at different angles, the ratio of the arm would change, providing a one to one reading is required. The movement of the plunger *D* is limited by the pin *G*, which also allows the plunger to project so that it will come in contact with various diameters of the work. This gage is very easy to handle and will be found of great assistance in the inspection department.

That Loose Pulley Nuisance Again

By Ellsworth Sheldon

That the loose pulley always was, and probably always will be, a source of annoyance, cannot be gainsaid, though many shopmen have worked out solutions that have lessened, and perhaps for a time eliminated, the trouble. Each shop has its own particular kink for keeping that usually noisy adjunct more or less quiet



A NEW MATERIAL FOR AN OLD PURPOSE

and well behaved and each man therein will stoutly aver that the method of that shop is the best.

However that may be, the writer has stumbled upon a new way, or rather an old way using a new material, and is herewith passing it along in the hope that someone else may be benefitted. The shop wherein it was found is located somewhat remotely from metropolitan districts and in a region where the red oak tree abounds, which may account for the selection of wood from that particular kind of tree as a cure for loose pulley ailments.

The pulleys in question were of the ordinary cast-iron variety, to be found in any machine shop, running upon a shaft that sometimes rotated and sometimes did not, thus bringing the pulley to bear upon a different part of the shaft's circumference every time the latter stopped revolving. This condition wears the shaft

quickly out of round and is responsible for most of the trouble.

The pulley hubs were bored as shown in the sketch, ¾ in. larger at each end of the hub than the new shafts, and generously chambered out at the center to form an oil reservoir. A bushing of cast iron was made for each with walls ⅜ in. thick, and before the final cuts were taken the walls were drilled radially with ⅛-in. holes so spaced that about half the inner bearing surface was cut away.

Round "rods" of red oak wood, slightly more than ⅛ in. in diameter, were then produced upon the pattern-maker's dowel machine and plugs cut from these rods were driven tightly into all the holes in the bushings. Finish cuts were then taken over the bushings, inside and out; the bore being finished by hand reaming.

A suitable closed oil cup was provided for each pulley, the bushings forced into their respective hubs, and the job was completed. I have the word of the proprietor that all the pulleys that were so treated are running quietly and that some of the first of them had been up for several years.

"How often do you oil 'em"? I queried. "Oh! once in six months or so," he replied.

Use of Paper in Determining Close Measurements

By Gus Haessler

An article on the uses of paper in the shop, published on page 850, Vol. 54, of the *American Machinist*, was of more than ordinary interest. In this letter I am

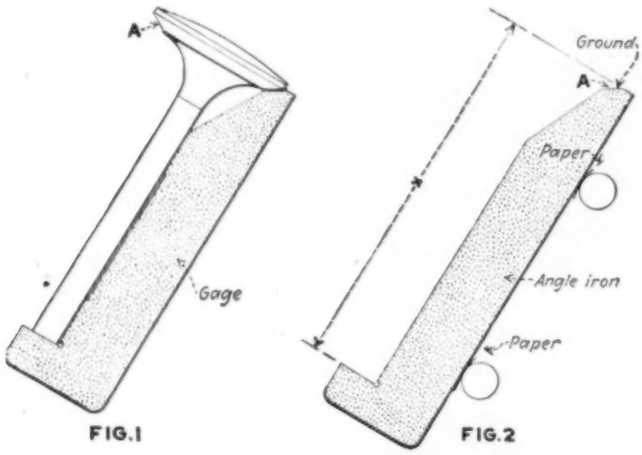


FIG. 1. THE VALVE TO BE GAGED. FIG. 2. SUPPORTING GAGE TO GRIND THE ANGLE

showing two cases where paper was effectively employed.

Fig. 1 illustrates a gage for measuring a poppet valve. The angle A on the gage is ground as is shown in Fig. 2. When the gage is clamped preparatory to grinding, it sometimes moves away from the pins and the movement passes unobserved by the operator. Strips of paper placed between the pins and the edge of the gage would indicate this at once.

In Fig. 3 this same gage is shown set up on angle iron for checking the dimension x. In checking gages of this type in any considerable numbers, it is not practical to coat the gage surfaces to be measured with Prussian blue, and paper was therefore used.

To check this dimension the height gage was first set to a few thousandths of an inch above the surface A and a strip of tissue paper held upon the surface of the work while the gage was adjusted to pinch the paper slightly. The reading thus obtained was then

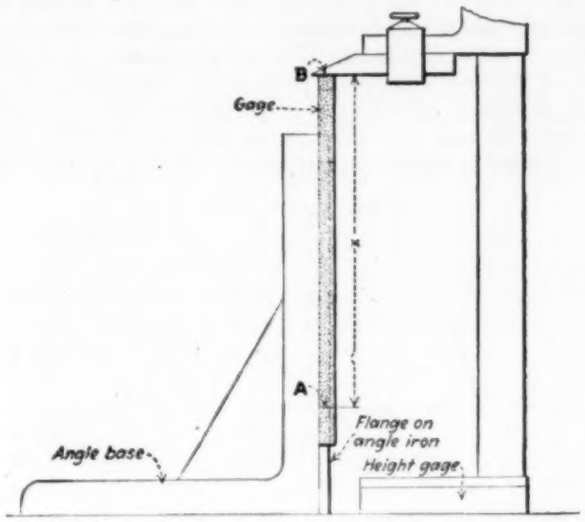


FIG. 3. TESTING BY MEANS OF STRIPS OF PAPER

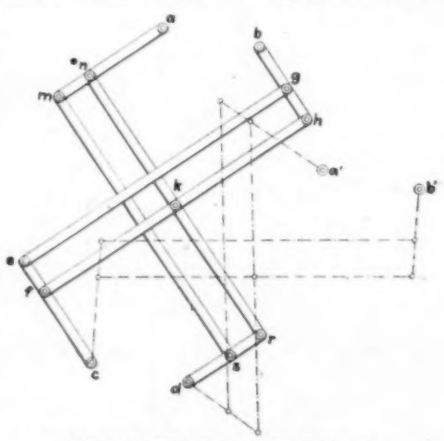
added to the dimension x and the height gage set to this. If the work is ground to correct dimension the scriber should now pinch the paper slightly when passing over the surface B.

Parallel Double Tongs

By Vladimir Karapetoff
Professor of Electrical Engineering, Cornell University

In the development of a piece of new electrical apparatus, the writer needed a kinematic device for transmitting a given distance between two points parallel to itself. For this purpose he developed the special tongs shown in the accompanying figure. Since the device may have several useful applications, apart from the special purpose for which it was built, a description of it is here given. The fixed distance is cd, and the construction is such that $ab = cd$. The tongs may be moved in any desired position, such as is shown by the dotted lines, and the distance $a'b'$ will still remain equal and parallel to ab.

If cd is varied in any arbitrary manner, both in direction and in magnitude, ab, or $a'b'$, will change automatically, and always remain equal and parallel to cd. Thus, this device enables one to keep a point, such as b, at a desired constant or variable distance from point a, when the latter is moving in any arbitrary fashion in a plane. It also permits a stationary observer at cd to measure a



PARALLEL DOUBLE TONGS

constant or variable distance *ab* on a moving object.

If now the points *a* and *c* be kept stationary, then points *b* and *d* can be moved in any desired direction, provided that the distance *bd* remains equal and parallel to *ac*. It will be seen from the sketch that the tongs may be utilized one way or the other, depending upon the relative magnitude of the distances *ab* and *ac*.

The device consists of eight members. The four long bars are of the same length; the short bars *bh* and *dr* are of equal length, and so are the bars *ce* and *am*. The lengths *an* and *fc* must be equal, and each of them must be equal to *bh* or *dr*. The pivot joint *k* must be at the center of the two long bars which it connects. The proportions of the device are arbitrary and depend entirely upon the range of distances for which it is to be used.

Burnishing Tools for Babbitt Bearings

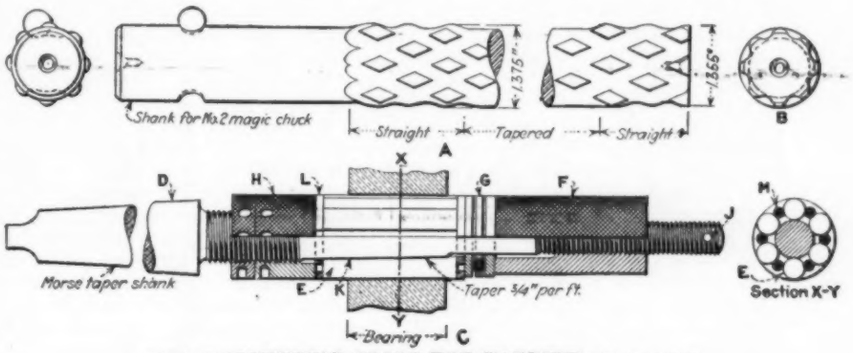
By William Owen

The two tools shown in the accompanying illustration are used for burnishing about $\frac{1}{64}$ in. out of connecting-rod and crankshaft bearings of automotive engines before line reaming. These tools press the babbitt against the wall of the bearing in the rod or crankcase, and insure a more perfect bearing and a denser babbitt metal.

The tool shown at *A* consists of a solid arbor with a number of right- and left-hand helical flutes, cut along the surface with about 6 in. lead. After the flutes are cut, the small diamond-shaped bumps that are left are rounded off, as shown by the section *B*. The tool is then glass-hardened and ground to the required sizes.

The tool shown at *C* is a little more expensive, and consists of a hardened arbor *D*, having a taper ground on it at *K*. This taper works inside a roller cage *L* composed of two flat rings and held together by six pins *M*, shown in the section *XY*. This cage carries six tapered pins or rollers *E*, which are held loosely and allowed to move in and out by means of elongated holes in the flat rings.

When inserting this tool, the feed nut *F* is back against the stop pin *J*, so as to allow the tool to slip through the bearing easily. After it has been inserted, the machine is started and the feed nut *F* is fed up against the thrust bearing *G*, which in turn pulls the tapered arbor *D* through the cage. This action expands the rollers, which press back the babbitt metal. The amount of expansion is adjusted by the stop nuts shown at *H*, and can be set to suit the conditions, so as to allow just enough metal in the bearing for line reaming.



TWO BURNISHING TOOLS FOR BABBITT BEARINGS

Squaring Up a Drawing

By H. T. Lundquist

It often becomes necessary to put a finished drawing back on the board for corrections or changes. The drawing is easily lined up when there is a long straight line to go by; but it is not so conveniently done when there is no such line, as in the case of a sheet full of small details.

The following scheme aids in squaring up a drawing quickly. When the blank sheet is first fastened down on the board, draw a short line at each end between the border line and the edge of the paper. These lines should not be allowed to run out quite to the edges of the sheet, as they may start tears at these points. When the drawing is replaced on the board, square it up by the lines.

Fixture for Pressing Small Bushings Into Connecting Rods

By Dwight Jordan

The fixture shown in the sketch was designed for the purpose of pressing bushings into the small ends of connecting rods for internal combustion engines.

Owing to the shape of the bushings, as shown in Fig. 1, difficulty was experienced in entering the tongues into their respective slots and it therefore became necessary to provide some means of locating them so that they would start right. The holding fixture and punch is shown in Fig. 2. It is quite simple and inexpensive to make, and in use was bolted to the thrust plate of an ordinary arbor press, the punch being affixed to the ram. By its use an inexperienced operator was enabled to press in the bushings much more rapidly than could have been done without it, even though plain bushings had been used.

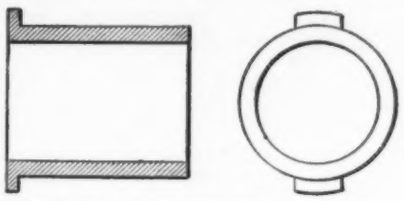


FIG. 1. THE BUSHING TO BE PRESSED IN

The drawing is quite self-explanatory and will need no description.

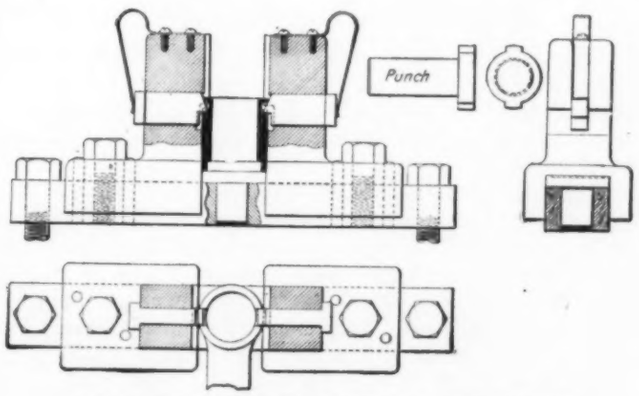


FIG. 2. THE FIXTURE USED FOR THE WORK

EDITORIALS

AMERICAN MACHINIST. [November, 187 7.

competent party after a satisfactory exa. mination. In our department of manufacturing information, all "news" we lo not know to be reliable, will be excluded, as well as all matter that has become ale by going the rounds of the press.

We also propose to lay before our readers gular information concerning exports of chinery and mechanics' supplies, digests he principal new patents relating to our alty, correct market reviews and price live editorials and varied technical ondence.

ur many friends and patrons who fully and so gratifyingly sustained uraged us in this undertaking, we r sincere thanks with the assurance confidence is not misplaced. Havld or damaged journalistic material se of, but with an entirely new riginal in its conception and present-igh style of typographical art, we on the stage, make our bow and long and pleasant acquaintance with e audience of readers.

Good vs. Medium Machinery.

The favor with which American machinery l tools has been received in foreign counies wherever introduced should be a source of pride to every intelligent mechanic in our country. Why have they been so well received? Clearly, because American machines and small tools are better made, more finely finished, and better adapted to the purposes for which they are designed than those of the same class made in Europe. So long as our manufacturers keep up and improve the standard of their productions we can expect to have an increasing foreign demand until "the workshop of the world" shall be on this side of the Atlantic instead of in England. But we wish to refer to the fact that many establishments previously sustaining a fair reputation for mechanical productions have, within a year or two, lowered their standard, still bring their wares on the market with the same endorsement as before. Since the depression in business caused the selling of

Keep Up to the Times.

The most rapid progress has been made within two or three years in perfecting small tools and supplies for the machine shop. Inventions of accurate and automatic machinery, for making such articles, have not only cheapened their cost, but have raised the grade of requirements, until the persistent use of some tools that were accepted three years ago as the best that could be procured, places a shop at a great disadvantage by the side of wide awake establisments, that are up to the times. The extra cost of buying the best and most improved tools and supplies, to replace those lacking in adaptation, efficiency, or accurate working qualities, is more than compensated for, by securing better facilities for business. Perhaps some will say, "O! we can't afford to buy new tools when we can't get work to keep the old ones employed." Our answer is: "There is a certain amount of work to be done whether business is slack or lively, and those shops that have well known facilities for doing the best and cheapest work, will get the orders. If you are behind your neighbors in this respect, catch up if you can, if you can't, come as near to it as possible, even should it involve an extra outlay or working tools."

Taps, dies, screw-plates, machine screws, calipers, reamers, drill-chucks, and lathe attachments, have been wonderfully improved within the time above mentioned, so have many other small articles for the machine shop, not now present to mind, A few months ago we called on a venerable machinist in a Pennsylvania town, and was much amused to see him working on an old fashioned lathe with "hook tools" (one end of the tool hooked over the shoulder,) which some of our present day apprentices may have heard their grandfathers describe. His shop, one of respectable size too, was no place to sell new-fangled notions. Various degrees of backwardness may be found in modern machine-shops, as well as in those of older date, but the above case we commend to some of our enterprising commercial travelers.

Tuition in Mechanics.

According to a table recently compiled showing the occupation of the parents of pupils who have attended the Pittsburgh high school during the past ten years, it appears that a majority of the students belonged to the artizan class. A recapitulation of the table shows that during the period named 698 children of skilled laborers have been in attendance: of unskilled laborers 232; of merchants and storekeepers, 258; of professional men, 154; of widows, 128; of office holders, 36: miscellaneous, 209.

Probably the school records of all our large manufacturing cities and most of the smaller would show on examination a preponderance of pupils whose parents belong to the mechanical class. Considering that the boys are likely to follow, when they become old enough to select an occupation, very much the same line of business that their fathers have done, it is pertinent to inquire whether they receive at school any instructions in the elements of mechanical knowledge.

A little tuition in the first principles of mechanism, illustrated by simple experiments and accompanied by conversational lectures on the part of the teacher, is what should be insisted upon in every high school or grammar school in our country. The "course in Natural Philosophy" dwelt upon in the curriculum of most public schools of the higher grade, is too often nothing more than a mere routine of text book study, which instills into the pupils' minds scarcely anything of permanent value, but rather begets a distaste for mechanical research.

Without the aid of books an interest should be created by the competent teacher in the elementary principles of mechanics and a spirit of inquiry developed in the mind of the young learner. All of us know how lasting are youthful impressions, and how easy it is to acquire in a short space of time at an early age tastes and inclinations that shape the future course of a busy life. Do parents sufficiently examine into the way their children are "educated" in the public schools? This is obligatory on their part. Skilled workmen, and to such we address ourselves, should insist upon having teachers em-

This editorial appeared in the first issue of the *American Machinist* forty-four years ago. It might almost have been written this year for the arguments it employs apply as well to modern conditions as to those existing in 1877.

Apparently human nature changes but slowly for the first editor of the *American Machinist* found it necessary to admonish the inert and unprogressive manufacturer of 1877, just as the present editors have had to reason with his many successors during the year now happily drawing to its close. Blind conservatism maintains its grip on some of us to a surprising extent. There is a lesson here which is easy to read. In those dark ages of the machinery industry there were alert and aggressive men who believed that the best equipment was none too good for the competition ahead of them. They had the courage of their convictions and their faith was justified. Is there any reason to believe that similar business sagacity will not be equally profitable to-day?

The calamity howler is in his element now as doubtless his ancestor was in 1877. But good times came in spite of him and of his timid manufacturing brothers. They are coming again and coming soonest for those who are prepared to go out to meet them. The prosperous periods in the last forty-four years will fade into obscurity before those of the next forty-four. Let's get ready for them!

Shop Equipment News

The Bryant No. 2 Double-Head Hole-Grinding Machine

The Bryant Chucking Grinder Co., Springfield, Vt., has completed a hole-grinding machine that is a departure from standard practice in that it carries two levers of the left-hand head, and then the head itself; the direction of movement being opposite to that of the main bar.

With the mechanism in the position shown, the head to the left is free to slide on the main bar, and the first movement of the capstan wheel to the left brings the

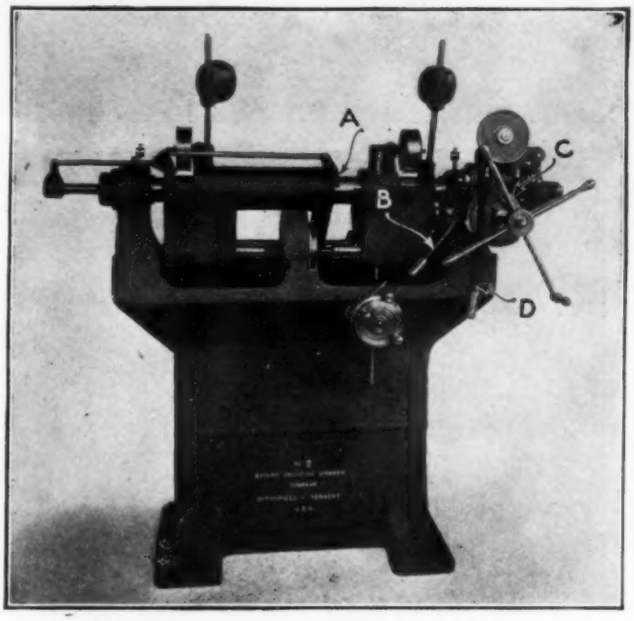


FIG. 1. BRYANT NO. 2 DOUBLE-HEAD HOLE-GRINDING MACHINE

opposed spindles and is capable of grinding a hole from both ends simultaneously. It therefore eliminates the long spindle that would otherwise be required and removes the principal cause of bell mouthing. It also cuts the grinding time practically to one-half that of a single wheel.

The machine is designed primarily for the purpose of grinding the pin holes in pistons of gas engines. A front view, Fig. 1, shows the arrangement of the principal parts. A revolving chuck, driven by a small, round bolt, is located in the middle of the machine bed and two sliding and swinging heads are mounted upon the round bar above.

All the movements are controlled by the capstan wheel and traversing mechanism at the right, and this

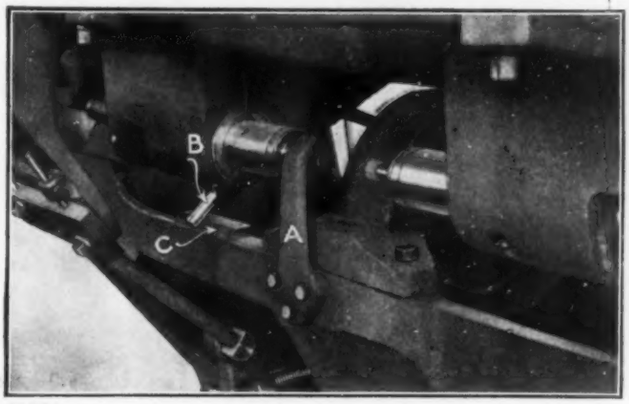


FIG. 4. BACK OF MACHINE; REDRESSING OF WHEELS

mechanism is the same in its main features as that of the standard Bryant machine. Power is applied to this mechanism through a round belt from the overhead countershaft.

In the operation of grinding, both heads are clamped to the bar and move as a unit, the distance between the grinding wheels being so adjusted that both wheels are in the cut together, one grinding one end of the hole while its mate grinds the other end. To change the work in the chuck it is, of course, necessary to separate the heads and this is accomplished by a single movement of the capstan wheel, the same movement that withdraws the grinding wheels.

On the shaft of the capstan wheel are two friction-driven pinions, one meshing with the rack on the main bar at all times, and the other meshing with a rack that is in or out of service according to the position of the operating lever. This second rack, through the medium of a long rod extending lengthwise through the center of the main bar, moves first the clamping

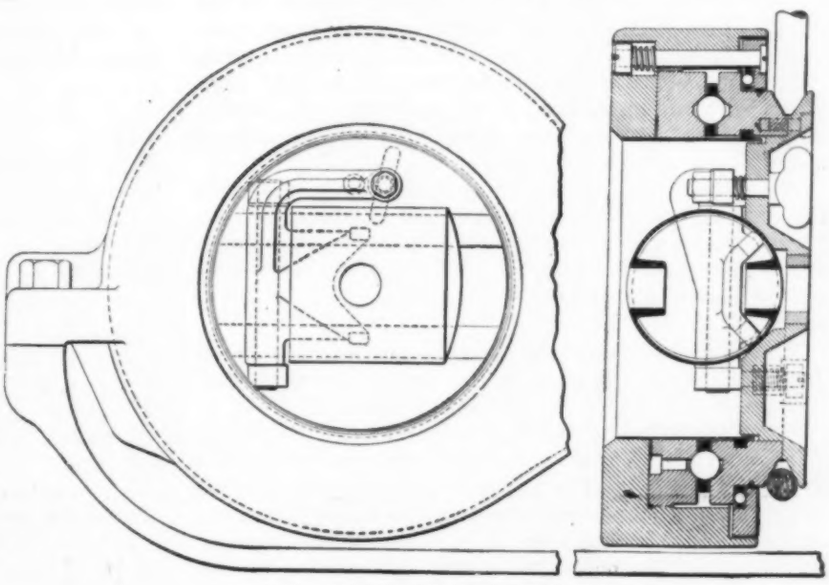


FIG. 3. DETAIL OF CHUCK

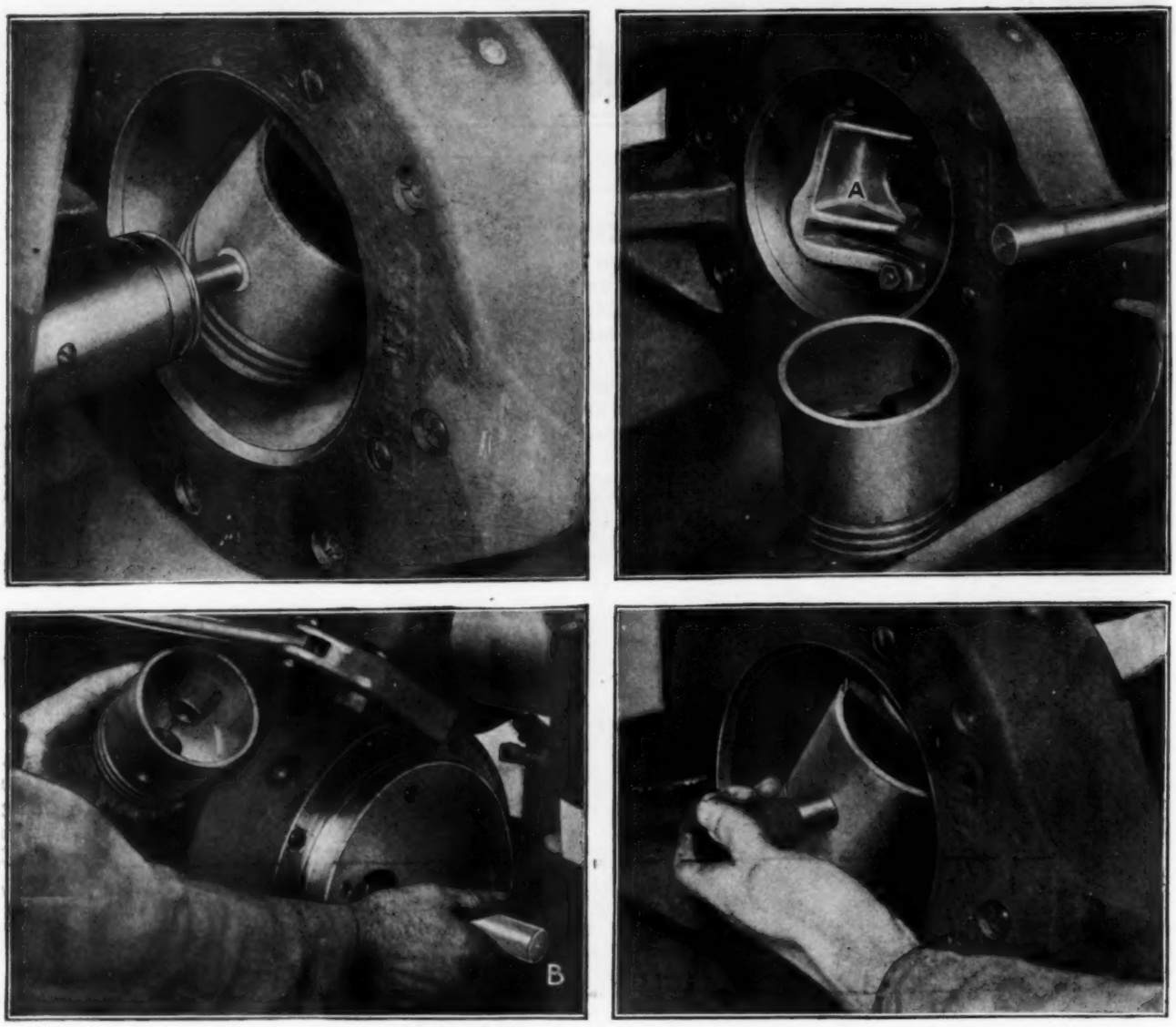


FIG. 2. POSITIONS IN LOADING THE WORK

heads together, entering the grinding wheels in the work. The toe *A* on the clamping lever strikes an adjustable stop on the opposite head as the two heads come together turning both levers to a vertical position and clamping the head to the main bar. No further movement of the capstan wheel is possible without slipping one or other of the friction pinions.

A movement of the operating lever *B* now drops the second rack out of engagement and at the same time brings the power movement into action. Both heads now move together during the grinding operation, driven by the pinion that is still in mesh with the rack of the main bar.

The length of the power traverse movement is determined by adjustable reverse dogs in the wormwheel *C*. The lever *D* is for reversing the movement by hand.

When the grinding is completed, or when the operator wishes to gage the work for size, the operating lever is disengaged and the capstan wheel turned to the right. The first movement starts the main bar in the same direction and (the second rack now being in mesh) at the same time moves the clamping levers to the left as far as they will go. Further movement continues to move the main bar, and with it the fixed head, to the right, but draws the opposite head to the left; separating the wheels to the predetermined limit. As the wheels are now clear of the work, the entire head may be swung back out of the way as in the standard Bryant grinding machine.

In the combined halftone, Fig. 2, may be seen some of the movements necessary to chucking the work, while the line drawing, Fig. 3, shows the details of the chuck itself. As may be seen in this illustration the chuck is open at all times on the left side and is closed on the right by a circular plate having at its center a hardened steel bushing to assist in positioning the work.

The piston is set over the swinging clamp shown at *A* Fig. 2. An undersized plug (fitting the bored hole in the work and having a shoulder to fit the bushing in the chuck plate) is inserted from the right as at *B*, and the clamp tightened by means of the thumbnut to be seen under the operator's right hand. Opposed to the clamp is a parallel V-block that accurately centers and aligns the work. These movements are all that are necessary to chuck a piston and are performed in a very few seconds. The grinding wheels are now brought into action as above described.

In grinding a single hole with two wheels in this

manner it is of course essential that the wheels be exactly of the same diameter and parallel. What thus appears to be a difficult proposition is accomplished in a very simple manner, as a reference to Fig. 4 will show.

A diamond is mounted in the bracket *A* at the back of the machine in such manner that when the wheels are swung to their backward position, as when changing work in the chuck and brought together to the lengthwise position occupied when grinding, they are in position for redressing. The pin *B* sliding upon the hardened plate *C*, holds the heads in position and insures a parallel traverse. The traversing is done by the same mechanism as in grinding and with the same movements, either by hand or power.

Feeding the wheels to the work in grinding, or to the diamond in redressing, is done by the handwheel on the front of the machine.

The machine uses the standard Bryant internal grinding spindles, which run upon ball bearings at a speed of approximately 20,000 r.p.m. and are entirely self contained. As they are independent of the driving pulleys and driven from them by a floating connection, they may be removed from the machine by the turning of a locking screw without disturbing the belts. The spindle driving pulleys run upon independent ball bearings, as also does the chuck or work holder.

The machine occupies a floor space of 3 x 6 ft., and the net weight is 2,300 lb., including countershaft. For independent driving a 3-hp. motor with a rotor speed of 1,720 r.p.m. is recommended. The chuck will take pistons up to 4½ in. in diameter by 4½ in. long. The equipment includes two standard internal wheel heads with an assortment of wheels, diamond and holder, countershaft, and necessary wrenches.

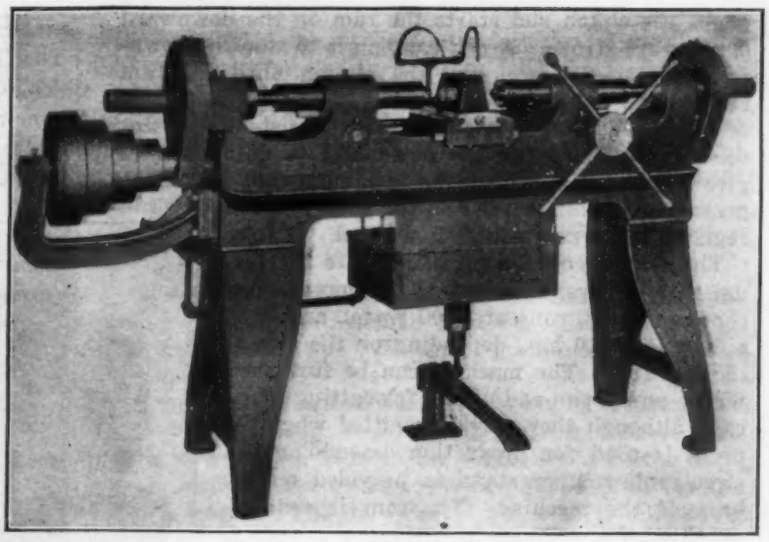


FIG. 1. MURCHEY REAMING AND CHAMFERING MACHINE

Murchey Reaming and Chamfering Machine

The machine shown in the accompanying illustrations has lately been placed on the market by the Murchey Machine and Tool Co., Detroit, Mich., and is intended for reaming and chamfering nipples. Fig. 1 is a front view of the machine, while Fig. 2 is a close up showing the simplicity of the tools and vise.

The nipple is held in a central vise which is opened by pressure on a treadle and closed automatically when the foot is raised. The spindles carrying the tools are brought to the work by the pilot wheel shown at the right of the illustration.

After a nipple has been reamed and chamfered it is knocked out by the insertion of the next nipple and drops into the receptacle provided. The vise has hardened and ground jaws, slides on wide bearings and centers itself as the tools start cutting, so as to bring the work in the proper position.

The countershaft has two drive pulleys intended to be run at different speeds. This arrangement, together with a four-step cone pulley, provides for eight changes of speed. The capacity of the machine is for nipples for ⅛ to 2-in. pipe, and in length from close to 12 in. The output is claimed to be six hundred and fifty ¾-in. or three hundred and fifty 1½-in. nipples per hour, other sizes in proportion. Weight, approximately 1,200 lb. Floor space, 8 x 2 ft. An oil pump is included in the equipment.

While primarily designed for reaming and chamfering the machine can be equipped with dies for threading nipples from ⅛ to ¾-in. pipe size. It can also be arranged for threading tees, valves, studs and other work required to be threaded on both ends, or for performing other operations on small parts.

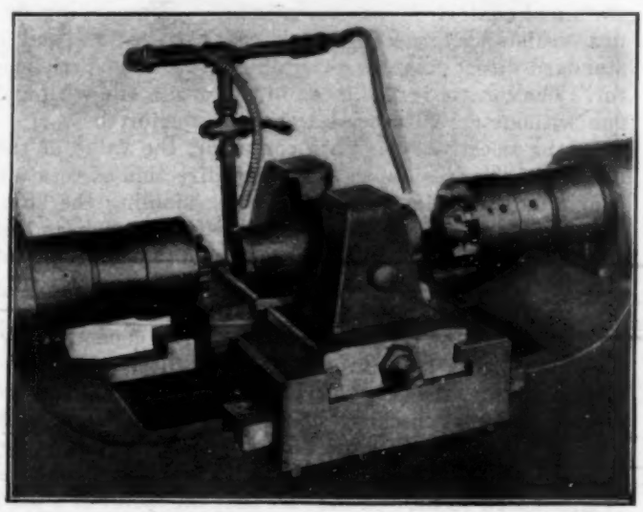


FIG. 2. SIMPLE TOOLS AND VISE ON NIPPLE MACHINE

Lucas Vertical Broaching Press

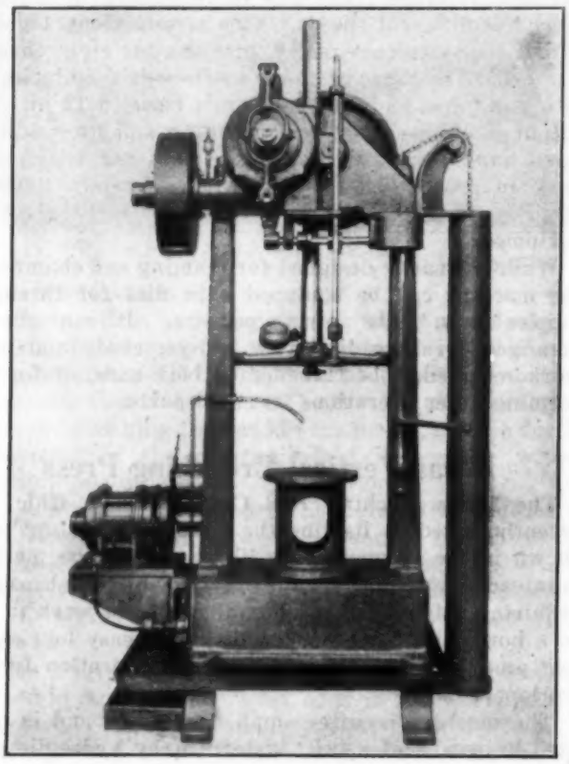
The Lucas Machine Tool Co., Cleveland, Ohio, has recently added to its line the vertical broaching press shown in the accompanying illustration. The machine is intended especially for the operation of push-broaches, requiring only short broaches, allowing the work to rest in a horizontal position, permitting of easy lubrication and providing a convenient means of operation for the workman.

The machine requires small floor space and is operated by means of a belt, instead of by hydraulic pressure from an accumulater. The working elements consist principally of a ram to which motion is transmitted through gearing that is controlled by a friction engaging a wormwheel driven continuously from the pulley shaft. The lever for controlling this friction is adjustable vertically on a rod placed in front of the right-hand column. Movement of this lever to the left en-

gages the clutch and starts the ram on the downward or pressure stroke. A dog can be set to stop the downward movement, reversing the motion until the ram reaches the top of the stroke and is stopped by means of a second dog. The friction device consists of asbestos washers between friction disks and is adjustable to give any pressure within the maximum capacity of the press. A gage is mounted on the ram, so as to register the pressure that is exerted.

The machine can be furnished with individual motor drive, as shown. The motor is of constant speed, runs at 1,200 r.p.m., and is of either 7½ or 10 h.p., depending on the size of the machine. The machine can be furnished with a pump, pan and piping for cutting lubricant, although they may be omitted when the press is used for production assembling. A circular broaching stand is provided on the base of the machine. The ram is counterweighted.

The machine is ordinarily made in two sizes, having capacities of 15 and 30 tons, respectively. The maximum distance from the base to the ram is 48 in. for both sizes, although a high-pattern type of machine may be furnished with this dimension either 60 or 72 in. The distance between the housings is 25 in. for the small machine and 30½ in. for the large. With the driving pulley running at a speed of 500 r.p.m., the speed of the ram on the power stroke is 9 ft. per minute on the small machine and 6 ft. per minute on the large one, the speeds on the return stroke being 21 and 15 ft.

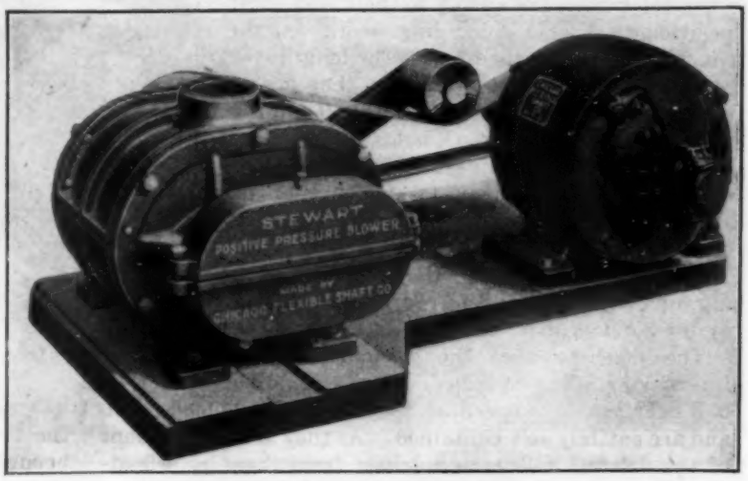


LUCAS VERTICAL BROACHING PRESS

per minute respectively. The net weights are respectively 2,900 and 3,800 lb., and the contents when boxed for export 125 and 150 cubic feet. The machine is adaptable to a considerable range of work, because of its capability of handling large and unwieldy parts.

Stewart Motor-Driven Blower Unit

The Chicago Flexible Shaft Co., 5,600 Roosevelt Road, Chicago, Ill., has combined the Stewart positive-pressure blower with a motor to supply an apparatus whereby the heat-treating furnace can be maintained as a separate unit independent of the main power plant. The unit thus formed, which is shown in the illustration, is known as the Stewart motor-driven blower unit.



STEWART MOTOR-DRIVEN BLOWER UNIT

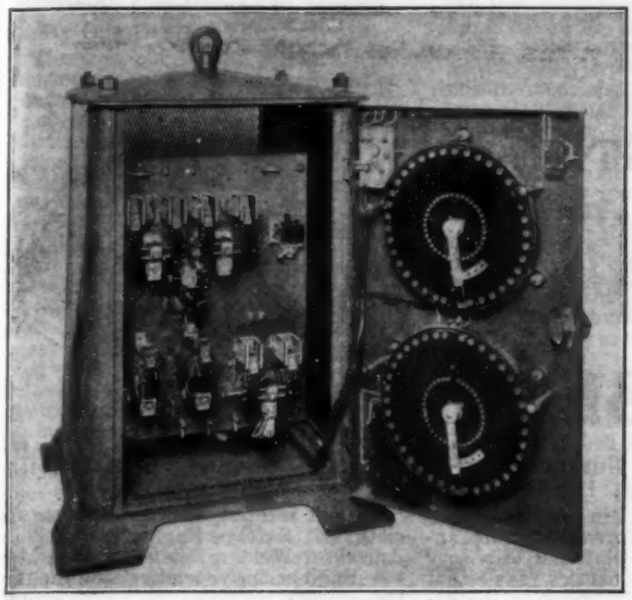
This apparatus obviates the expense of running the large plant motor when only enough power is required to operate the blower, and is particularly adaptable for small installations. It is made in four sizes accommodating blowers Nos. 3 to 6 with motors of from 1 to 2½ horsepower. Voltage and type of current should be specified when ordering.

G. E. Planer Control

The General Electric Co., Schenectady, N. Y., has recently placed on the market an apparatus for preventing the tables of electrically controlled planers from over-traveling. The apparatus employs the dynamic system of braking for stopping the table, and is said to prevent over-travel either on reversal or because of the failure of the voltage. The equipment consists of a control panel on which are mounted the necessary rheostats and contactors, as shown in the accompanying figure, resistance, master switch or push button, and a standard direct-current, reversible adjustable-speed motor. The control is furnished in two types, one with and one without a resistance-selecting contactor.

In the selective-resistance contactor, the value of the dynamic brake resistance for either direction of rotation can be adjusted independently, thus enabling the stopping of the table in the proper position at each end of its stroke. It is possible to set the braking effect at 200 instead of 100 per cent of full load, thus greatly reducing the overtravel.

The method of control is said to give dependability, as well as ease, certainty and adaptability, and also to conserve time. In case the contactor tips should become welded together because of severe service conditions, the planer table will stop, but will not overrun its set limits. Should a failure of the voltage occur, overtravel is eliminated because of the fact that the motor is always connected on the dynamic brake.

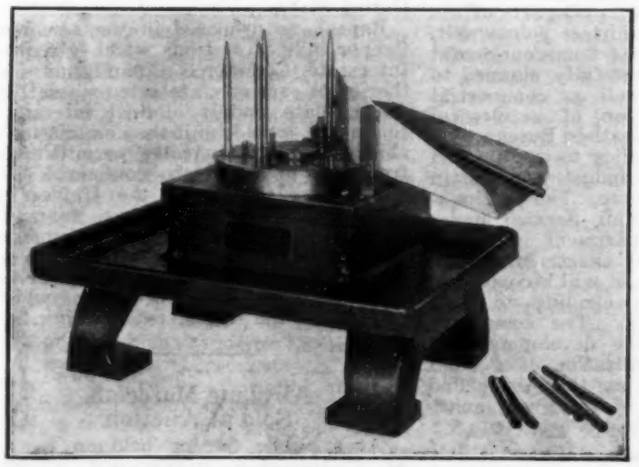


G. E. PLANER CONTROL

It is claimed that the control makes possible the performance of many operations of a difficult nature. It is possible to "jog" the table, using either a master switch or a push-button station. The selective resistance contactor enables the machine to operate on jobs allowing but small tool clearance, and also on those where the duty varies from no load to full load, and where cuts are made to the end of the travel. The time efficiency in such work is stated to be very high, because of the decreasing of the wasted or idle time of the machine.

Noble & Westbrook Marking Machine

A marking machine recently brought out by the Noble & Westbrook Manufacturing Co., Hartford, Conn., for marking names and patent marks on small tubing is



NOBLE & WESTBROOK MARKING MACHINE

illustrated herewith. The machine is power driven through a three-step cone pulley, the power being transmitted to the table of the machine through a worm-and-worm gear.

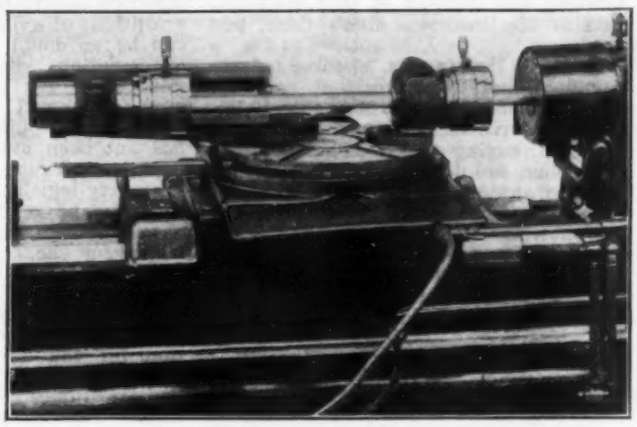
The top or table of the machine revolves. It is divided into six equal parts, each having a mandrel upon which the work is fed by hand. As the table revolves, it passes the work over the die and makes the mark. Then a cam raises a small lever, ejecting the work from the machine automatically. In this way, all the operator has to do is to feed the work to the mandrels. A production of over ten thousand per day is estimated. The machine is made especially for the job and it can be furnished for marking on the end of any size tubing of short lengths. It weighs about 90 pounds..

Acme Staybolt Attachment

The attachment illustrated herewith has been brought out by The Acme Machine Tool Co., Cincinnati, Ohio, for use in connection with turret machines of its manufacture.

Two dieheads are used and when set by a master- or staybolt tap, their simultaneous cutting insures that both threaded portions on the staybolt will be the same as to lead as if a continuous thread had been cut the whole length. The die head at the rear is adjustably mounted so that any length of staybolt within range of the adjustment can be cut.

The attachment is made to fit the 2¼ x 26-in., 3¼



ACME STAYBOLT ATTACHMENT

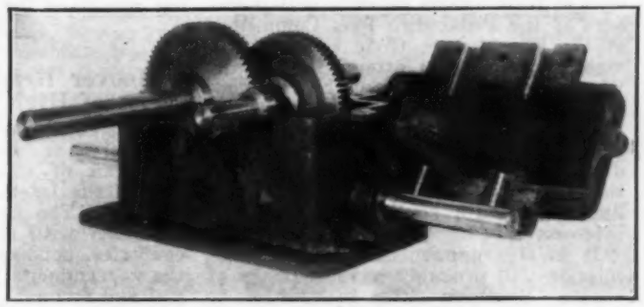
36-in., and the No. 3 universal machines, and by its use staybolts can be made from forgings or from a bar.

Natisch Combined Worm and Spur-Gear Speed Transformer

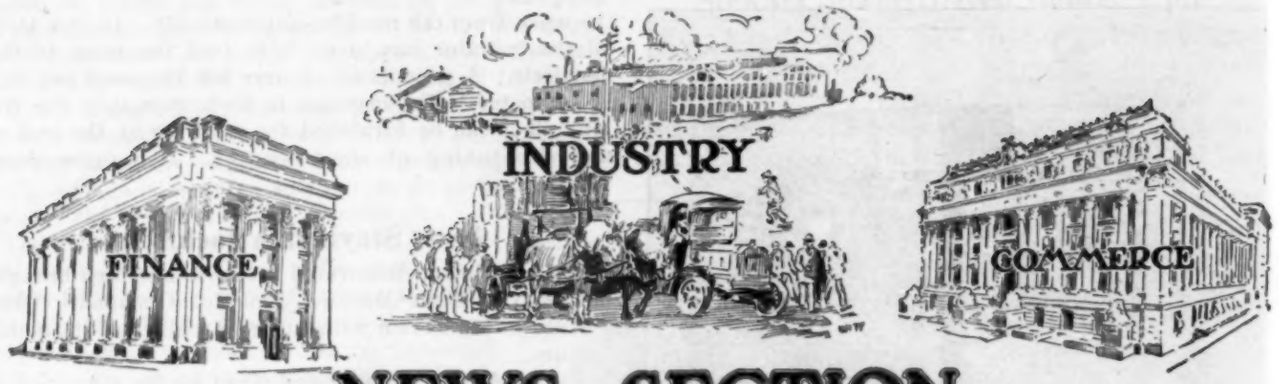
The speed transformer shown in the accompanying illustration has been placed on the market recently by the Natisch Gear Works, 451 Hudson Ave., Brooklyn, N. Y.

By changing the ratios of the gearing the transformer can be furnished for speed reductions ranging from 75-1 to 600-1. The illustration shows a transformer for delivering ½ hp. at a speed reduction of 600-1.

The case is cast iron, oil tight and rust proof.



NATISCH SPEED TRANSFORMER



NEWS SECTION

Cincinnati Engineers Add Thirty-Three Members

F. L. Raschig, C. A. Paquette and E. K. Ruth were elected members of the board of directors of the Engineers' Club of Cincinnati (Ohio), at the annual meeting and banquet of that organization at the Business Men's Club, last week.

John L. Harrington, speaker of the evening and vice-president of the American Society of Mechanical Engineers, criticised the engineers of America, saying that members of that profession are less in public life than those of any other and as a consequence are less advertised.

Following his talk the names of thirty-three new members were read, including nineteen engineers engaged in the machine tool manufacturing business and the remainder in other lines of industry.

To Study Coal Movements

Private funds in sufficient amount to make possible comprehensive study of seasonal coal movements have been placed at the disposal of the Committee on Mining of the President's conference on unemployment. This is the first of a series of surveys which are to be carried out by Edward E. Hunt, the secretary of the conference, in cooperation with the Department of Commerce.

Pittsburgh Plus Case to be Heard

Elliott Cheatham, of Atlanta, counsel for the Southern Association of Rolled Steel Consumers, states that preparations have been virtually completed for the Southern hearings in the celebrated Pittsburgh Plus case, which are to begin before the federal trade commission some time during the early part of January. Mr. Cheatham was in conference at Birmingham recently with members of the Pittsburgh Plus Committee of the Birmingham Civic League, this meeting being also attended by B. R. Bane, counsel for the trade commission.

The South and West won a preliminary victory in the case last April, and prominent men of the metal trades industries of the South are confident that the January hearings will result in a final victory for southern and western interests that are affected.

It is also announced that the commission will probably have hearings at various Southern cities in addition to Pittsburgh and Chicago.

Government Air Bureau Favored by President Harding

President Harding, in a special message to Congress, forwarding the annual report of the National Advisory Committee for Aeronautics, says that America should be foremost in the development of aviation. He thinks there can be no doubt that the development of aviation will become of great importance for the purposes of commerce, as well as for national defense. After pointing out that aviation has not been extensively developed in America because of lack of wise and necessary legislation, he urges that this condition be remedied by the creation of a bureau in the Department of Commerce for the regulation and development of air navigation.

In its annual report, the National Advisory Committee for Aeronautics urges the enactment of legislation for the development of aviation and for the establishment of airways and airdromes under Federal regulation. The committee expresses the opinion that if this is done, air lines for the transportation of passengers and of goods will be rapidly established by private enterprise in all parts of the country. The committee points out, however, that the first transcontinental airways should be carefully planned to serve military as well as commercial needs. The extension of aerological service under the Weather Bureau, and the adoption of a policy to sustain and stabilize the aircraft industry, are again urged by the committee. The continuation of the Air Mail Service under the Post Office Department is recommended until, by the enactment of appropriate legislation, it will become possible for commercial air lines to operate air mail routes. The committee also recommends the development of airships and the utilization of a small amount of helium at this time, and urges conservation of the great existing resources for future use.

Hoover Heads U. S. Section of High Commission

President Harding has appointed Secretary of Commerce Hoover as chairman of the United States Section of the Inter-American High Commission. The commission, established by treaty with all the South American countries, acts as an advisory body to the governments in perfecting commercial and financial practices between the countries.

Safety Engineers Confer With Welding Society

A joint meeting of the American Society of Safety Engineers and the American Welding Society was held in the Engineering Societies' Building on the evening of Dec. 20. The general theme of the meeting was a discussion of the development of safety in oxy-acetylene cutting and welding operations.

Two papers were presented. F. J. Napolitan, of the Davis-Bournonville Co., spoke on "Safety Engineering as applied to oxy-acetylene cutting and welding."

J. I. Banash, of Chicago, presented a paper on the "Development of Oxy-acetylene Process." Mr. Banash invited discussion and the audience joined in some spirited arguments on the merits of the ideas put forth in the paper.

Chamber of Commerce Protests Capper Bill

A fair trial for the Transportation Act of 1920 has been asked of Congress by the Chamber of Commerce of the United States.

Repeal, as proposed in the so-called Capper bill, of sections which give the Interstate Commerce Commission authority to correct state rates when they discriminate unduly against interstate commerce, would limit the commission's ability to maintain rates permitting a free flow of interstate commerce, Dr. Emory R. Johnson, of the University of Pennsylvania, speaking for the Chamber, told the Senate Commerce Committee at a hearing on Dec. 15. At the same time Dr. Johnson attacked the proposal to repeal provisions which established the rule of rate making.

Airplane Materials Sold at Auction

At a public auction held on Dec. 9 at Philadelphia, government officials sold materials, said to be enough to build fifty complete airplanes, for the sum of $1,000, which was the highest bid. The purchaser remains a mystery, the bid being made by an agent said to be representing a "Mr. Brown."

The material has been held in the government warehouse for over a year because of an injunction held against its English owners for infringement on Curtiss and Wright patents. The purchaser took over the responsibility for the suits now pending in the matter.

Trade Conditions in Russia

By Our Latvian Correspondent

There is not in the whole world so enormous, so eager, and so empty a market as Russia. Foreign goods from needles to locomotives could be used in Russia. In Russia at present there are 130 million inhabitants; in 1912 when there were 180 millions, Russia's import was valued at 640 million dollars. During the four years that Russia was blockaded, she was unable to import anything, but the population continued to consume. In 1913 the production of the industry of Russia was valued at 1.5 billion dollars, but in the last four years the industry has become so crippled that production has fallen way below this figure. Today the starving population has no shoes, no clothing, no household fixtures or implements of trade; machinery in the factories and shops is completely broken down; pharmacies and stores are empty, and the transport system is crippled.

The natural resources of Russia are rich and should easily support a healthy import trade, the fault lies in the bad management of the Soviet government, which must be altered before Russia will be ready for international trade. By a special agreement between the Russian government and a Mr. Hodgson, the British agent in Moscow, there has been formed a Russian Import-Export Company, to do business with foreign countries on behalf of, but under the supervision of, the Soviet government.

During 1920 and 1921 the imports into Russia were rather small. The Bolsheviki had trouble with their gold; some countries refused to accept it and that there was danger that the goods which they shipped to foreign markets would be confiscated there in the favor of the various complainants. Some countries refused to recognize the trade officials of Soviet-Russia, but the chief difficulty was the lack of a sufficient gold supply. The Soviet government imported only from countries with whom she was able to make commercial treaties, or who were more or less friendly toward communistic ideas. Therefore, imports from the United States and France fell off. At present Germany and England are the leading traders in Russia, although the traffic is now occupied mostly with American relief supplies.

As the Soviet government is not able to satisfy the wants of the people because of a lack of means and private merchants are not allowed to enter foreign trade, there has developed a system of contraband—or smuggling. This is being carried on extensively especially on the boundaries of Latvia and Esthonia, which countries have food and manufactured products in abundance. The profits are royal and the frontier guards are easy to bribe. Latvia has established a system of "barter places" on the frontier. These places are fenced in; the contrabandists from the Russian side are allowed to enter and trade with the Latvian merchants under the supervision of Latvian customs officials. Duties must be paid and when the deal is closed the Russians return homeward, where they must bribe the frontier guards in order to get the goods into their own country. From the Latvian side the barter is considered lawful; from the Russian it is contrabandism. Of course, the Russian government is fully informed of this situation, but it is impossible to keep the hungry people in check when neighbors have an abundance of worldly goods. The government of Latvia has no intention to maintain these barter places for a long time; it regards them as evil, but one cannot always choose his neighbors.

In the main the export trade of Russia is small and it cannot grow without foreign assistance. In order to collect export goods one should have real money, gold or manufactured articles to pay for them. The Russian Import-Export Company has enough British manufactures and will be able to gather considerable quantities of export goods. The Soviet government having only valueless paper money, can gather but little. This fact should be remembered by those who wish to sell to Russia. The real salvation lies in foreign credit. Russia has asked England for about 200 million pounds sterling for agricultural machinery, to be purchased in England. Perhaps a part of the sum which was recently granted to stimulate the export trade of England, will go to Russia; but it is doubtful that England will risk a very large amount until the government of Russia has been altered.

The communistic government of Russia has made important changes in its economic policy, abandoning partly the communistic doctrines and returning in a small way to capitalism. Recently, the government declared that it would pay the old foreign debts of Russia. This move was, no doubt, to gain the faith of capitalistic countries and to attempt to establish a broad international credit. Russia has much to change, much to promise and much to do before the necessary credit will be extended to her. There is but one alternative for Russia: she must starve or capitulate. The sooner the communistic regimé is changed, or entirely abolished, the better for Russia, the world and especially the labor class.

French Plan Portuguese Air Service

It is reported by the Department of Commerce that the French company, Transaerienne de Tourisme et Messageries, is making overtures to the Portuguese government for valuable concessions in Portugal and the islands, and also in Portuguese Africa. American Minister Thomas H. Birch states that the company proposes a mail and passenger service for Lisbon, Paris being the starting point. Free transportation of Portuguese mail and the relinquishment of air material to Portugal in case of war are some of the inducements offered by the company.

Alabama Iron Production

Pig iron production in Alabama for November was officially announced at 108,201 tons, which is some 7,000 tons less than the unofficial figures announced earlier in the month. Production, however, was almost 8,000 tons better than the previous month, and brought the total for the first eleven months of the year to 1,081,280 tons. As the iron and steel industries are improving rapidly, December production will undoubtedly be considerably in excess of November, bringing the year's total to very nearly 1,200,000 tons This, however, will make 1921 one of the lowest years of the past decade, for in recent years annual production has always been above 2,000,000 tons.

Optimism from Near East

At a dinner of the American Chamber of Commerce for the Levant, held on Dec. 20, L. I. Thomas, president of the chamber, and a director of the Standard Oil Company of New York, made a statement which should interest exporters and importers, as well as business men in general. He has just returned from an extended trip to the Near East and has visited a number of points in Jugoslavia, Bulgaria, Turkey, Greece and Rumania.

Mr. Thomas said that he was sorry to note from the press such pessimistic statements as have been made by a prominent American who has also recently visited that part of the world. There can be no doubt but that the political and economic situation leave much to be desired, but on the other hand, after talking with a great many Americans in the country, a rather deep feeling of optimism for the future is found there, from a business point of view—and this notably applies to Turkey.

Industrial Exhibit in Palestine

An exhibition of American machinery and products, under the auspices of the American Palestine Co., 874 Broadway, New York City, will be held in Palestine. The exhibit will start as soon as arrangements are completed and will be a permanent institution. The company will pay the shipping and duty charges on all products sent from the United States. All products exhibited will remain the property of the manufacturer to the extent of the selling price with discount to jobbers in the United States.

Changes in Canadian Tariff Law

American manufacturers who export their products to Canada should take cognizance of the new regulation which goes into effect on Dec. 31, 1921. A law was passed by the Canadian legislature in November which states: "That all goods imported into Canada which are capable of being marked, stamped, branded or labelled, without injury, shall be marked, stamped, branded or labelled in legible English or French words, in a conspicuous place that shall not be covered or obscured by any subsequent attachments or arrangements, so as to indicate the country of origin." The last words are important.

Goods coming into Canada after Dec. 31 which have not been properly branded, will be subject to an additional tax of 10 per cent ad valorem, and will not be released from the customs house until they have been marked according to the law.

Exports of Oil-Well Machinery

The value of oil-well machinery exported in November is reported by the Department of Commerce to be $320,828. This is a little less than half the value of the exports of oil-well machinery in November of 1920. The value of all other mining machinery exported during November was $324,775. A year ago exports under this latter item were valued at $654,277. The exports of pumps and pumping machinery during November were valued at $343,629. This is about one-fourth of the value of pumps exported in November of 1920.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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Although the streets of the New York shopping district were made almost impassable last week by the holiday throngs, the retail merchants report that there has been no extravagance and that the demand has been chiefly for articles of utility rather than for unnecessary luxuries. This is reassuring, as thrift is essential to real prosperity, but it is disappointing to those who associate lavish expenditure with the holiday season and there is less of what might be called commercial jollity to be noticed in the shops. Reports from other large cities indicate a similar repression for economy, though salutary, does not inspire hilarity.

Perhaps it is because as the thirty-first of December approaches there is general realization of the fact that our gains for this year must be chiefly devoted to the payment of former losses, that nearly all the markets are somewhat slacker. The declines, where any have occurred, are almost negligible but the demand is a shade less eager than it was. This is particularly true of the bond market and it is entirely natural that the enormous bond sales of the last few months should be followed by a period of quiescence and digestion.

In the other markets the hesitancy shown must be attributed to extraneous influences for there is no speculative congestion in either stocks or merchandise.

Political Peace

The unfortunate ambiguity of the four power treaty whereby doubt is created as to whether the words "insular possessions and dominions" are to be construed as including the island empire of Japan itself, is probably the most important of these extraneous influences as a revision of the treaty now seems necessary to its ratification and the people are tired of this endless hairsplitting. What they want is peace and by peace is meant not only freedom from war but an end of the political and legislative uncertainty that is so disturbing to business.

The delay of the Irish Dail in ratifying the treaty agreed to in London is another disconcerting factor that is felt here as well as abroad.

Still another is Germany's insistence that she can only pay 200,000,000 gold marks on the reparation installment of 500,000,000 marks due in January and nothing at all on account of the 275,000,000 marks due in February. Almost concurrently the Reichsbank reports that 103 billion paper marks were outstanding Dec. 15 against which there was held a reserve of less than 1 per cent in gold. Meantime Professor Irving Fisher of Yale University, now in Germany, is quoted as saying that a German chemist has succeeded in making synthetic gold, and while the authenticity of this statement is doubted, it has brought into bolder relief the economic chaos in which "Mittel Europa" and Russia are involved.

One curious effect of all this financial disorganization is that the liquid capital of Teutonic Europe is seeking sanctuary in Switzerland and that American dollars are selling at a discount there while short time money is lending at 2½ per cent.

To try and bring order out of all this confusion Lloyd George is arranging to call an economic conference to be held in London or Paris where it is hoped remedial measures that are practicable can be agreed upon. Meantime foreign exchange remains remarkably steady and even marks continue salable in New York at from 50 to 60 cents a hundred. It is only when we contrast the enthusiasm that followed the opening of the disarmament congress with the "let down" now felt that we realize the intrinsic soundness of business conditions in this country. Our distributive trade seems fully up to normal.

The supply of credit is ample and while as a result of the holiday demand for currency the weekly statement of the Federal Reserve Banks shows increases of $54,000,000 in circulation and $100,000,000 in loans that are reflected by a 2 per cent decline in the reserve ratio it is probable that after the New Year the reserves will rise again. It is to be noted, however, that for the first time in many weeks the gain in gold is less than $2,000,000 and there are indications that it will be less rapid hereafter.

The developments in the commodity markets call for but little comment. Cotton is steady but the advancing tendency has been checked. By way of an antidote for its increased estimate of the American crop the Department of Agriculture has published a statement in which the world's cotton production for the current season is put at 15,593,000 bales, as compared with 20,650,000 bales last year. The Russian crop for this year is estimated at only 50,000 bales against 1,309,000 bales in 1914.

Sugar is attracting a good deal of attention. The Cuban Sugar Finance Commission which has controlled the sale of the Cuban crop for some time past has been abolished by Presidential decree as of Jan. 1, after which date the market will be free. Sugar futures are selling at or near two cents a pound for raw sugar landed in New York. This price does not include the present duty, which on Cuban sugar is 1.6 cents per pound.

As raw sugar has not for many years sold at less than 1⅝ cents per pound landed in New York, some patient speculators are now buying it upon the theory that a great staple is generally a good investment when it can be bought at approximately the lowest price on record. They may be right but they will probably have to be patient as the surplus supply is large.

The soft coal production for the year is estimated at 410,000,000 tons as compared with 535,000,000 tons in 1920. The industry has been and still is seriously hampered by labor unrest and the high cost of production and transportation has recently made it possible to sell Welsh coal in our Atlantic and Pacific seaports at less than the price of the American article. This Welsh coal is brought out as ballast in English steamers coming hither for cargo. Considerable quantities are on the way to Portland, Seattle and San Francisco.

High Rail Rates Prohibitive

The steel industry is quieter and it is stated that many orders are being withheld in the hope of lower rail freights after New Year's. This is the case in not a few lines of trade for the expectation of lower freight rates is very general and is adroitly encouraged by the railroad managers who seem to realize that the present high cost of transportation is restricting business in many directions. It is also holding the market for railway shares in check for would-be buyers of what would usually be considered bargains are deterred by the uncertainty. Thus far, however, there is no indication that the Interstate Commerce Commission is likely to order a reduction until the railroads themselves apply for it and Henry Ford's second application for permission to reduce rates on his road has been again denied.

The sensation created in Canada last week when the Bank of Montreal took over the Merchants Bank has apparently subsided and people there have been reassured by the confidence with which Sir Vincent Meredith and Sir Frederick Williams-Taylor, of the Bank of Montreal, expressed themselves at the annual meeting of their shareholders.

A decision of the Supreme Court at Washington in which an "open price" association was declared to be in restraint of trade, and therefore illegal under the Sherman law, has attracted wide attention. There are many such associations in this country that may have to be abandoned or reformed. No serious disturbance to business is, however, indicated and there is every prospect that after the American people have eaten their Christmas dinners and made up their balance sheets for the year 1921, they will return to their accustomed pursuits with the earnestness that their unique position justifies. At Christmas Eve it is especially satisfactory to report that Congress has appropriated $20,000,000 for the relief of the starving Russians and that the food that this money will buy will soon be on the way to these unfortunates.

India as a Steel Producer

India expects to be able to produce steel cheaper than any country in the world, according to the British press. The United Steel Corporation of India is perfecting arrangements for the construction of large works. While the exact site of the proposed plant is not mentioned, it will be at a strategic point between the coal and iron-ore deposits in Bihar and Orissa.

Plans for Washington Meeting of Engineering Council

Plans for the development of the work of the Federated American Engineering Societies were under discussion at a series of conferences and meetings held in New York last week. President Mortimer E. Cooley and executive secretary L. W. Wallace met with the American Engineering Council's committee on procedure on Dec. 16 and 17 at the Engineers Club, with the secretaries of the national societies. At these meetings questions of finance, publication and closer relations with member societies came up. General agreement was expressed on major questions of policy.

Subsequent to the meeting of the committee on procedure, chairman Calvert Townley announced further details of the Washington meeting of the council. On Jan. 4 the events of the meeting will get under way with a session of the executive board at the Cosmos Club, where the sessions of the council will also be held. On Jan. 5 the Council will convene for an all day session at which Dean Cooley will preside. The business of the council will include the election of three new officers, two vice-presidents and a treasurer.

Hoover to Speak

On the evening of Jan. 5 the council will give an informal dinner at the University Club to which the engineers of Washington will be among those invited. Herbert Hoover has been asked to attend and he has accepted, provisionally. Secretary Hoover is to spend the holidays in California and his presence is contingent upon his ability to arrange for his return to the capitol by this day. In addition to Secretary Hoover, other prominent speakers are expected to deliver addresses.

On Jan. 6 the council will again meet in business session and there will also be a meeting of the executive board, the new members of which will be elected by the delegates from the national organizations and the regional areas. Each region will choose one member of the board. Representation of the national societies will be determined by membership, the A.S.M.E. for example electing five.

The Unemployment Phase

At the Washington meeting the work of the past year will be reviewed and plans for the ensuing year discussed. Among the important reports to be received will be that of the special committee on unemployment. Other leading topics will be industrial waste. National Department of Public Works. Patent Office conditions and licensing. Proposed constitutional changes will also be acted upon.

The committeemen expressed the opinion that marked progress had been made during the past year and that, though many difficulties were ahead, the outlook was encouraging. The federation, it was felt, had made such progress as amply to justify its existence. Its purposes were becoming better known to the engineer and the public and it unquestionably is gaining ground as an effective instrument of coalescing and registering the viewpoint of the engineer in national government and administration.

What is characterized by Dean Cooley as one of the most instructive meetings he has yet called, was that which the secretaries attended. Dean Cooley made it plain that throughout his administration their assistance and co-operation would be consistently and earnestly sought. Questions of policy fundamental to the progress of the F.A.E.S. were frankly threshed out, the result being, according to Dean Cooley, a clarifying of procedure and aims. The secretaries of the founder societies presented their point of view very fully and clearly, particularly in regard to the publication efforts of the federation and the most effective methods of interlinking the member societies into a coherent unit which in order to function must be kept fully informed.

Export Statistics

A new schedule governing the classification of exports of domestic commodities will be put into effect on Jan. 1 by the Bureau of Foreign and Domestic Commerce. In order that the new regulations in regard to statistical returns of exports may be carried into effect, J. Hohn, chief of the bureau's Division of Statistics, points out that the co-operation of exporters is essential. It is absolutely necessary to the accuracy of the statistics that the shipper fill out his export declaration in accordance with the new classification.

S. A. E. to Standardize Auto Body Frames

Representatives of passenger-car frame manufacturers recently held a meeting and determined to undertake the standardization of passenger-car frames, as it is felt that such standardization would be of material assistance to passenger-car designers and to frame manufacturers. Information in reference to present frame practice is to be obtained as a basis for the standardization involved, a questionnaire requesting this information having been sent out to all manufacturers.

The standardization of frames will be of special assistance to many frame manufacturers, because passenger-car manufacturers are often willing to use a frame for which the frame manufacturer has the necessary tool equipment in case the design conforms fairly close to requirements. The adoption of definite frame standards will result in an increase in the number of such orders to the mutual advantage of both frame and passenger-car manufacturers.

The division has definitely recommended a standard for passengar-car running-board brackets which will be acted upon at the meeting of the committee on Jan. 10. The standard specified but three sizes of brackets, but they are designed so that these three sizes will furnish a suitable range for all requirements by slightly shifting the position of the rivet holes in the frame. The width of the brackets can be changed to fit the running board.

How Van Norman Company Sells Machine Tools

The growing tendency of machine tool salesmen to take the machines right to the prospective customer has resulted in the rigging as shown in the accompanying photograph. The machine mounted on the rear of the automobile is a Van Norman "Relio" grinder. It fits snugly on the back of the salesman's Dodge roadster and can be demonstrated to a customer at any place at a minute's notice.

The machine is fitted with electric motor drive, which can be connected with an ordinary lighting circuit from a lamp socket. All the necessary fixtures and tools are carried in the car. This method has brought more than ordinary success to the enterprising salesman who took this means of promoting his sales in places where the customer "had to be shown."

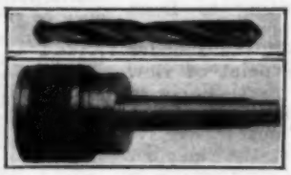
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Broken Twist Drill

Wayne Tool Mfg. Co., Waynesboro, Pa.

"American Machinist," June 30, 1921



The chuck is for holding twist drills which have been broken at the shank. It is said to be very simple and composed of only the shank, casing, two pawls, two screws and a casing plate. The drill, shown at the top of the illustration, is ground to a 60-deg. point at the broken, or right-hand end. This allows the drill to automatically center itself on a 60-deg. recess in the shank; and on turning the casing the drill is locked in place by the two pawls, gripping it in the grooves. No wrench is required to tighten or release the chuck. Since the chuck enables the use of broken drills which would otherwise be discarded, it is suitable especially to shops where twist drills are used in large quantities on production work.

Grinding Machine, Twist Drill

Oliver Instrument Co., Adrian, Mich.

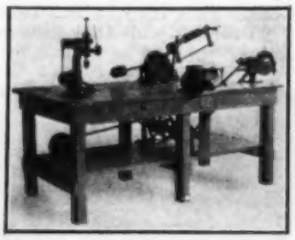
"American Machinist," June 30, 1921

The machine is said to involve a number of radial features in handling its class of work. It will handle the work automatically after the drill has been placed in position, thus avoiding variations of grinding due to the personality of the operator. The grinding wheel is mounted on an arbor supported by an arm arranged to give it an oscillating motion. The drill is held in a spindle mounted on a bracket on the arm at the right of the machine, and is arranged so that a rotating motion is imparted to it at the proper time. The grinding wheel arbor revolves in ball bearings, and is mounted on an oscillating cradle. The machine will grind two-, three-, or four-lip drills. No adjustment is required for grinding various sizes of drills. The drill point is in full view of the operator. The motions of the machine are all obtained by a simple mechanism contained in an oil-tight case. Net weight, 550 lb.

Bench, Work, Combination, No. 1

Myers Machine Tool Corporation, Columbus, Pa.

"American Machinist," July 7, 1921



The outfit is intended for use where a small machine equipment is required. All of the units are mounted on a table 39 in. wide by 78 in. long by 33 in. high. Two drawers are provided for holding small tools. The motive power is furnished by an a.c. electric motor, delivering ½ hp. when running at 1,750 r. p. m. The motor is belted to a countershaft, which permits the use of the machines either individually or simultaneously. The machine equipment consists of the company's No. 2 geared automatic hacksaw having a capacity of 6 x 6 in.; a 10-in. sensitive drilling machine having a ⅝-in. chuck; and a grinding head equipped with one abrasive wheel and one muslin polishing wheel. A 4-in. machinist's vise having hardened steel jaws is also mounted on the table. Weight, crated, 750 lb.

Toolholder, Universal, Rapid, "Uniheart"

Rapid Universal Toolholder Corporation, 199 Franklin St., New York, N. Y.

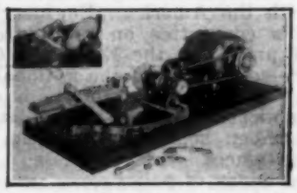
"American Machinist," July 7, 1921

The toolholder is intended for general use in a lathe, boring mill or shaper, and adapted to the holding of tool stock, boring tools, drills and such articles. As shown in Fig. 1, there is a square hole broached through at the front end of the shank, for the holding of square-section tool bits, both screws being tightened on it. Round, square or hexagon bars up to ¾ in. can be held transversely to the shank by passing them through the hole. For small bars the V-block shown is placed in the rounded bottom of the hole. For the holding of a parting or cutting-off tool, a special clamping device is provided, a conical-shaped piece, seen projecting from the hole in Fig. 2, holding the tool stock. The holder is made in two sizes.

Grinding Machine, Gear-Cutter, Small

Anderson Die Machine Co., Iranistan Ave. and Admiral St., Bridgeport, Conn.

"American Machinist," June 30, 1921

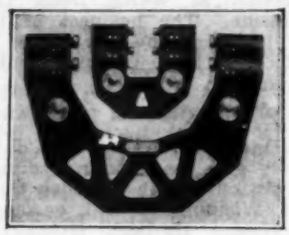


The machine is for grinding the teeth of small gear cutters, such as those used in automatic pinion-cutting machines for clock work. The chief feature of the machine is the fact that the indexing for each tooth is done with reference to the form of the tooth, rather than by equal spacing. It is claimed that errors due to hardening may thus be corrected in grinding, so that each tooth does the same amount of work. The machine is mounted on a base, together with a motor and switch. In the view of the complete machine the diamond is shown mounted for dressing the wheel, while the proportional view at the top shows the manner of mounting a cutter for grinding. For the purpose of positioning the grinding wheel so that the face of the tooth will always be radial, the gage in front of the machine is used.

Gage, Snap, Adjustable-Limit

Pratt & Whitney Co., Hartford, Conn.

"American Machinist," June 30, 1921

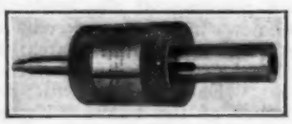


The frame of the gage is made in the form of a truss. The gaging anvils are of tool steel, glass hard. The anvils are adjustable, and the "go" and "no go" anvils may be set to any amount of tolerance desired. Each anvil is held in position by two opposed set screws. The gage, when set, may be sealed, so that the adjustment may not be disturbed without leaving evidence. The anvils are made with large heads to allow the gage to be used close to a shoulder. Two separate buttons of brass, the parts of which are held together and to the frame by a single small screw, are furnished with each gage for stamping sizes, tolerances, and shop numbers, thus enabling the user to put a permanent marking upon his gage without striking it. The gage is made in fifteen sizes, to gage from 0 to 12 in., the possible adjustment of each gage overlapping the next size in either direction.

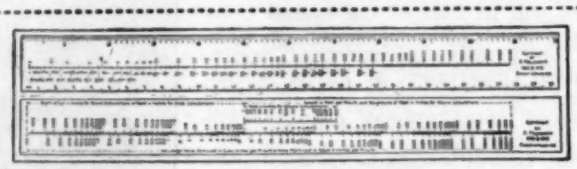
Chuck, Drill, Cushion, Safety, Universal

Karge-Baker Corporation, Phoenix, N. Y.

"American Machinist," July 7, 1921



The chuck is intended for the holding of drills, dies, taps and similar tools. It is provided with a "cushioning" feature which permits a moderate relative rotation between the shank and the socket ends of the chuck. A helical steel spring having a square section transmits the driving torque. It is claimed that the use of the chuck largely eliminates the breakage of drills and taps, and that it acts as a chip breaker. The shanks and sockets can be furnished in the size and style desired, and different styles are interchangeable on the chuck. The thrust is taken on double ball bearings, and an adjustment is provided to compensate for wear. The chuck is capbale of operation in any position. It is made in five sizes to carry drills from ⅛ to 4 in. in diameter, taps from ¼ to 7 in., or die heads from ⅞ to 9 in. in size.



Rule, Calculating, Machine Shop, "Universal"

R. Poliakoff, 709 Sixth Ave., New York, N. Y.

"American Machinist," July 7, 1921

The purpose of the rule is to enable the quick and accurate solution, without making any calculations, of problems relating to the speed of cutting work in a lathe or grinding it in a grinding machine. It is intended for solving problems showing the relation between the diameter of the bar, the cutting or grinding speed and the number of revolutions; and those involving the length of bar, feed, number of revolutions per minute and the time required to turn or grind the bar. The charts on the rule were previously described in the **American Machinist**. The inch and millimeter divisions have been added to permit the use of the rule for measuring. The rule is made of celluloid, but can be made of steel. It is 12 in. long.

Clip, paste on 3 x 5-in. cards and file as desired

Europe Making Progress with Economic and Political Problems

Secretary of Commerce Herbert Hoover has issued a most interesting statement on the condition of Europe today, tracing developments back to the end of the war in an effort to show that the countries of the continent are slowly recovering their stability and have made considerable progress toward a prosperous era.

The economic recovery of Europe is necessarily slow and difficult. It contains great dangers, but it is not at all as gloomy as some statements would make it appear.

Year by year since the Armistice, the combatant states (except Russia) show steady gains in social and political stability; they show great progress in recovery of agriculture, industry, foreign trade and communications. The one field of continuous degeneration is that of governmental finance—that is the unbalanced budgets, the consequent currency inflation, etc., of certain countries with its train of credit destruction. The commerce of the whole world obviously suffers grievously from this failure in fiscal finance and the apprehension that flows from it, and unless remedies are found the great recuperation in the five great fields of social, political, industrial, agricultural and commercial life of the past three years are endangered. Its effects spread constantly outside the borders of those states predominately concerned and substantially check our recovery also.

The most eminent and most dangerous of these unbalanced inflation situations is Germany. Her case depends upon the method and volume of reparation payments. As the United States does not participate either in its control or its receipts we have no voice or right to interfere. In any event this is peculiarly a European matter and must be adjusted by the parties at interest. It is earnestly to be hoped that the present negotiations upon reparation may succeed in finding a sound basis that will secure permanent economic and political stability to Germany and certainty of regular payment to the Allies. With this effected the way is open for constructive consideration of the situations in other states. The American people have never been and will not be remiss in participation in these further measures, but our people cannot successfully enter until those who have control of the reparations have settled this major issue upon so sound an economic basis that we can look upon the future of Europe with confidence.

Outside of the government finance of a limited number of states, the outlook is very encouraging. Any general survey of the social situation in Europe will show that the danger of Bolshevism is passed, partly through improved standards of life and partly through the salutary lesson of Russia. Democratic institutions are gaining strength among the 150,000,000 people formerly supporting autocracies. In Russia itself extreme communism is slowly boiling to death in a caldron of starvation and its leaders freely acknowledge its failure.

In the field of international political relations, aside from conflict in Turkey, war has ceased and treaties of peace are effective throughout the world. Russia no longer threatens any serious military offensive. The warring states have settled for a time their major territorial issues and while there are remote forces of instability such as irredentism, yet the new boundary alignment is securing acceptance and the agencies for allaying international friction are proving themselves steadily more effective. There are bright prospects of limitation in naval armament. Agreed limitations in land armament are not very hopeful but the economic pressure of taxes and unbalanced budgets is slowly disarming Europe and it will disarm more of them yet. The number of men under arms has decreased by fully a million in the past twelve months.

In the field of economic life, the progress of agricultural and industrial production year by year since the war is very marked. Famine has disappeared from Europe except in Russia. Except in countries where credit machinery is checked by danger fiscal bankruptcy such as is the case of Austria, their food, fuel and clothing supplies are sufficient albeit at a low standard of living in some places, but in even these countries the standards are much higher than the low point after the Armistice, and are thus not such a factor of discontent as would otherwise be the case. Populations have fairly settled to work and industrial efficiency and productivity is being steadily restored. The private credit institutions of the world are demonstrating their ability to handle the international trade and credits except for those regions excessively disabled by the currency demoralization. Transportation and communications have been reconstructed. There are some useless hindrances to freedom of healing processes of commerce through artificial barriers between the new nations but by and large the processes of healing are going on.

Generally, there is progress and the problems yet to be solved are being steadily narrowed and their solutions better understood.

Naval Ordnance Board Helps Army Technical Staff

Referring to the work of the special board on Naval Ordnance, Rear Admiral C. B. McVay, Chief of the Bureau of Ordnance, in a report to the Secretary of the Navy says:

"Examination and report has been made on the numerous inventions relating to guns, mines, fuses, torpedoes, and other ordnance material submitted to the bureau. But few of these have been found to be of new design or adaptable to service use or not containing ideas already covered by patent. However, encouragement has been given to their presentation for research and experiment.

"The meetings of the ordnance committee of the Army technical staff have been regularly attended and by this association touch has been kept with the progress and work of Army ordnance.

"In the development of ordnance material, the board took up the general question of aircraft offense and defense against aircraft attack and the improvements of material accessory to both, including airplane sights, bombs and fuses, and anti-aircraft guns. The improvement in illuminating shell has been given consideration.

"This board is of assistance to the department since it affords an opportunity to study ideas presented and to select those having promise. It is also of great value to persons presenting ideas, since a prompt opinion on the merits of the idea saves expenditure of time and money by the patentee."

Distribution of Tools

The 2,408 machine tools that were sold by the War Department to educational institutions throughout the country are classified as follows: engine lathes, 70 per cent; milling machines, 10 per cent; grinders, 10 per cent; shapers, 5 per cent; planers, 2 per cent and miscellaneous, 3 per cent.

Exports of Metal-Working Machinery in November

There was no appreciable change in the volume of exports of metal-working machinery in November, as compared with those of October. The value of all metal-working machinery exported during November is given by the Bureau of Foreign and Domestic Commerce as having been $672,810. This is some $7,000 less than the total in October. While the exports for the month show a heavy decline from November of 1920, there was an increase over October in the value of goods sent to France, United Kingdom, Canada, Argentina and Japan. The detailed figures which have just become available are as follows:

	Nov. 1920	Nov. 1921
Metal working machinery:		
Lathes	589,444	67,911
Other machine tools	1,131,461	270,923
Sharpening and grinding machines	237,395	61,962
All other	1,373,323	272,014
Total metal-working machinery	3,331,623	672,810
Exported to:		
Belgium	245,759	2,880
France	359,975	135,669
Italy	44,939	240
Norway	7,871	362
Spain	74,365	17,274
Sweden	25,836	3,614
United Kingdom	951,541	93,530
Canada	214,225	60,696
Mexico	31,203	27,291
Cuba	232,826	10,137
Brazil	72,389	45,419
Chile	22,882	10,866
China	68,742	7,272
British India	79,869	97,265
Japan	300,503	65,551
Australia	101,197	10,258
Netherlands	.....	3,322
Argentina	.....	44,063
Dutch East Indies	.....	.....
Other countries	497,501	36,711

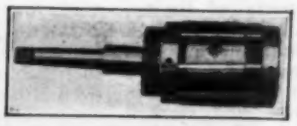
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Reamer, Cylinder, Expansion, Pilot-Blade

New Britain Tool and Mfg. Co., New Britain, Conn.

"American Machinist," July 21, 1921.

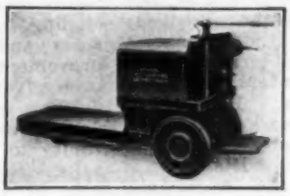


The reamers are designed to be used in pairs, a roughing and a finishing reamer for each oversize of gas-engine cylinder. The pilot portion of the roughing reamer is ground to fit the normal bore of the cylinder with which it is to be used, while the cutting portion of the blades is so made as to remove about 0.030 in. of stock. Similarly, the pilot of the finishing reamer follows the bore left by the roughing reamer, and the blades remove about 0.005 in. of metal. The device is said to provide a very simple means of reboring worn or scored gas engine cylinders. The tools are made in the form of shell reamers, and shanks can be furnished with either Nos. 3 or 4 Morse tapers.

Truck, Industrial, Electric, Elevating Platform

Cowan Truck Company, Holyoke, Mass.

"American Machinist," July 28, 1921.

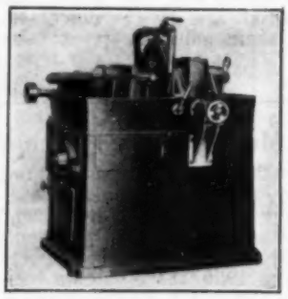


In design the truck is said to have been greatly improved over the former machines of the same type made by the concern. It has three speeds in either direction and steers upon all four wheels, so as to give a turning radius for the extreme outside point of the truck of 7 ft. 5½ in. The platform lifts vertically, having a capacity of 5,000 lb., and requires but five seconds to rise to its full height. It may be stopped at any point and reversed, if desired, no matter in which direction it is traveling. All of the controls are conveniently centralized, so that the operator may face in any direction that he desires. The lifting mechanism is operated by a separate series-wound motor.

Grinding Machine, Poppet Valve Seat

Fitchburg Grinding Machine Co., 76 Winter St., Fitchburg, Mass.

"American Machinist," July 28, 1921.

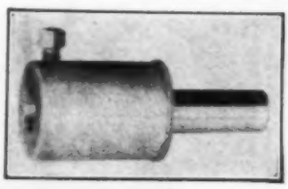


The valve being ground is held in a collet chuck, which can be swung to any angle. The head carrying the chuck has automatic reciprocating movement parallel to the wheel spindle, so as to feed the work across the wheel. The wheelhead has a cross movement and is operated by the vertical lever directly in front of it. The machine is self-contained, and is operated by a 3-hp. motor in the base. The weight, including the motor, is approximately, 2,500 lb. Besides grinding valves, the machine can be adapted to a large variety of small parts.

Holder, Tap and Die, Clutch

Warner & Swasey Co., Cleveland, Ohio.

"American Machinist," July 28, 1921.

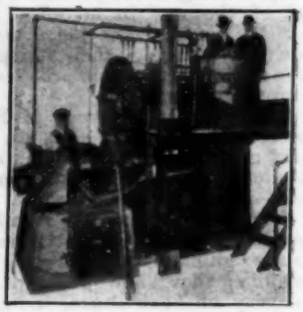


The tool differs from the old model of holder made by the same concern in the fact that it is greatly simplified, only eight parts being used, while twenty-three were used in the old model. The tool is capable of holding either right- or left-hand dies or taps, the difference when used for right- or left-hand work being in the position of the pawl. When threading is being done, the pawl holds the tool rigid by a metal-to-metal contact, until the turret stop is reached. The head of the holder then moves forward on the work and pulls the cam over the pawl, thus releasing the head and allowing it to revolve freely. A spring is used to cushion the pawl.

Shaper, Gear, Multiple, Vertical

Stevenson Gear Co., Indianapolis, Ind.

"American Machinist," July 28, 1921.

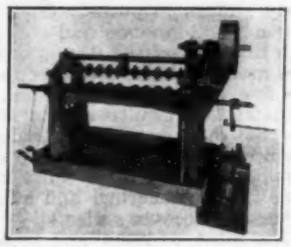


The machine cuts all or a large proportion of the teeth in a gear, or similar product at one operation. The tool-head is stationary and carries a number of tools spaced radially. The work is reciprocated vertically, being carried on a ram in the cylindrical portion of the frame. The work is indexed automatically between each stroke, so that each tool cuts in each tooth space. The tools are fed in as the cutting occurs, a stop being provided to limit the depth. A reverse feeding movement relieves the tools on the back stroke of the ram. The machine is made in sizes, the one shown handling gears up to 12 in. in diameter, 6-in. face and 4 diametral pitch.

Cutting-off Machine, Tube, Multiple

Nathan F. Fretter, 9113 Columbia Ave., Cleveland, O.

"American Machinist," July 28, 1921.

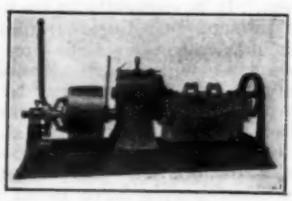


The machine is intended for cutting long pieces of pipe or tubing into a number of short pieces at one operation. A number of rotary cutters are mounted on a shaft, which is driven through back gearing and a driving pulley. The table has a dovetail groove, in which slide roller tube rests or holders, each adjustable to correspond with the positions of the cutters. The table is raised to feed the work, by means of cams operated by a treadle. The machine has a large capacity, according to the number of cutters used, and will cut tubes 2½ in. outside diameter having a wall ⅛ in. thick.

Burning-in and Running-in Machine, Universal

Theodore W. Jansen Machine Co., 739 Twenty-First St., Des Moines, Ia.

"American Machinist," July 28, 1921.

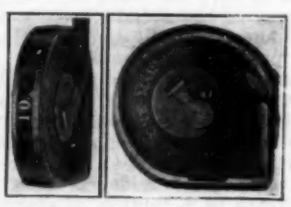


The machine is designated as No. 560, Type J, and is compact, low and heavy in construction. It is driven by means of a belt on a 16-in. wide-faced pulley, a lever-operated friction clutch being incorporated in the drive. Back gears running in oil are provided, thus giving two speeds, the ratios of reduction being 3½:1 and 1½:1. It is stated that the machine will hold all types of motors without special blocking or fixtures. The work is mounted on the stand by securing it at each end to pivoted holders, so that the motor can be rotated about its shaft and held in any position desired. Eight to 15 hp. is said to be sufficient to operate the machine.

Tape, Steel, "One Man"

Union Tool Co., Orange, Mass.

"American Machinist," July 28, 1921.



The tape has several distinctive features, which include a hook on the end of the tape, a heel on the case, and a locking device which holds the reel in position after a measurement has been taken. The features contribute to the ready applicability of the tool, by enabling one man to make measurements ordinarily requiring two men. A measurement is taken by hooking either the free end of the tape or the heel of the case over the edge of the object to be measured, running out the tape to the length required, and then reading the measurements through the window in the top of the case.

Business Items

The Anchor Machinery and Supply Co., has been incorporated at Brooklyn, N. Y., with a capital stock of $20,000. Directors are J. M. McNamara, T. P. Mackey, and J. A. Male.

The Porcelized Metal Corporation has been organized at Buffalo, N. Y., to manufacture license plates and other metal products. August Ebke is president of the corporation which has a capital of $150,000.

The Andrews Iron and Steel Corporation, capitalized at $75,000, has been organized at Utica, N. Y., Directors are S. W. Andrews, of Whitesboro, N. Y., and O. J. McKeown and C. A. Schmidt, of Utica.

The Frank Held Tractor Co., has leased a factory building at 609 N. Fourth St., Columbus, Ohio, and as soon as machinery is installed will begin the production of tractors and parts.

With the approval of the stockholders, the Pullman Company has purchased the property and assets of the Haskell & Barker Car Co., Inc., of Chicago, Ill. The Pullman Company will assume all debts and obligations, and will increase the capital stock of the H. & B. Company to $135,000,000. Three new directors in the Pullman Company are E. F. Carry, J. R. Morrow and A. O. Choate. Mr. Carry was the president of the H. & B. Company.

Reorganization of Walden-Worcester, Inc., manufacturers of wrenches, has been completed. The company will resume manufacturing operations at its factory in Worcester, Mass. J. V. Critchley was elected president; W. S. and L. E. Bellows will assume the management.

It is expected that the new machine shop of the American Car and Foundry Co., at Terre Haute, Ind., will be completed and in operation by Feb. 1. The old shop was destroyed by fire several months ago. The new shop is of modern steel construction and is equipped with several new machines.

As a preliminary to the sale of the Harley Company plant in Springfield, Mass., attachments amounting to $1,046,700 have been discharged, the major portion of which had been put on by the Hendee Manufacturing Co., which has had a controlling interest. New York and Philadelphia capital has been interested in the works, and it is anticipated that the sale and reorganization of the property will bring a revival and expansion of operations for the manufacture of drop forgings, brass, bronze, aluminum and copper castings, steel and brass casket hardware.

The Bass Foundry and Machine Co., Fort Wayne, Ind., has increased its capital stock from $1,700,000 to $2,100,000.

The Auto Metal Body Corporation, of Springfield, Mass., has enlarged its force and is operating its plant at full capacity.

The General Electric Co.'s plant at Pittsfield, Mass., is now operating at from 10 to 15 per cent above the lowest point, according to a statement by C. C. Chesney, general manager. About 50 per cent of the business is said to be on foreign orders.

Personals

E. D. BATCHELOR, district sales manager in St. Louis for the Jones & Laughlin Steel Co., has been appointed sales manager of the wire department and will assume this duty at the Pittsburgh headquarters on Jan. 1. Mr. Batchelor has been with the company for thirty-two years.

PHILIP A. RHINEHART has been appointed superintendent of production at the Anderson Foundry and Machine Works, Anderson, Ind. He was formerly with the Hill Pump Co.

J. ELMER ANDERSON has severed his connection with the Hendee Manufacturing Co. of Springfield, Mass., and is now in the engineering department of the Hart & Hegeman Manufacturing Co. of Hartford, Conn.

H. B. MACFARLAND, consulting engineer, of Chicago, formerly engineer of tests for Atchison, Topeka and Santa Fe Railway Co., has recently returned from England. During the past year he installed and tested the Lewis draft appliance to the latest type of large Mogul engine on the London, Brighton & South Coast Railway.

C. F. MEYER, assistant secretary of the Landis Machine Co., Waynesboro, Pa., manufacturers of bolt and pipe threading machines, has returned from a year's trip around the world. Mr. Meyer's itinerary included India, Java, China, Japan and the Hawaiian Islands.

GARFIELD HOOD, has been appointed sales manager of the Ontario Steel Products Co., with headquarters at Gananoque, Canada.

P. D. REID, president of the Reid-Newfoundland Co., of Canada, has returned from a three-months visit to England. He reports that development work to cost $7,000,000 is to be done at Humber Bay, the Armstrong-Whitworth Company having been awarded the contracts.

V. E. HILLMAN, metallurgist at the Crompton & Knowles Loom Works, Worcester, Mass., addressed the Springfield (Mass.) chapter of the American Society for Steel Treating on Dec. 16. His subject was "The Efficiency of Different Mixtures for Cyanide Hardening," and the lecture was illustrated.

W. W. MACCLEARY, for many years associated with the Whitaker-Glessnes Co., at Portsmouth, Ohio, and during the war in charge of the raw material purchases of the War Department ordnance bureau, has been made district manager at New York for the Warren Iron and Steel Works, Warren, Ohio.

LAWRENCE J. STODDARD, who had resigned as sales manager for the small tools department of the Greenfield Tap and Die Corporation, will assume the position of sales manager of the Lakeside Forge Co., Erie, Pa., on Jan. 1.

H. O. PETERSON has joined the Chicago branch office of the general sales department of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass.

W. E. HILL has recently joined the general sales department of the Gilbert & Barker Manufacturing Co., West Springfield, Mass. Mr. Hill will be the representative of the company in Grand Rapids, Mich.

Obituary

CHARLES H. BARRETT, president of the Meadville Wrench Co., and director in the Barrett Machine Tool Co., died recently.

JOHN MCCLARY, president and founder of the McClary Manufacturing Co., London, Ontario, Canada, died suddenly last week. He was ninty-three years old.

THOMAS B. DOWSLEY, inventor of the Downsley spring, and president of the Dowsley Spring and Axle Co., Chatham, Ontario, Canada, died recently at Owen Sound, Ontario.

JOHN BINDLEY, chairman of the board of directors of the Pittsburgh Steel Co., died at his winter home in Florida on Dec. 20. He was seventy-five years old.

Trade Catalogs

Lead Screw Variator. Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa. Circular describing a machine for obtaining precision lead from a lathe lead screw. Another device described in a similar circular is the multi-graduated precision grinder.

Special Ingersoll Milling Machine. Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating and describing a new special, heavy, adjustable housing, milling machine, 27 ft. long and 31 ft. 10 in. wide overall. It weighs 150,000 lb.

Pneumatic Products. Chicago Pneumatic Tool Co., Chicago, Ill. Special publication No. 674, describing a line of pneumatic tools, including riveting, chipping and calking hammers; air drills and grinders; geared hoists, winches and motors.

Sullivan Pumps. Sullivan Machinery Co., Chicago, Ill. Catalog 70-W, 71-F and 71-G, describing a line of air lift pumps, displacement pneumatic pumps and rotator hammer drills.

Boring, Drilling and Milling Machine. Pawling & Harnischfeger Co., Milwaukee, Wis. Bulletin No. 4-F illustrating and describing a horizontal, floor type boring, drilling and milling machine, with standard equipment.

Clark Band Saw. Clark Tool Works, Inc., Belmont, N. Y. A well prepared catalog illustrating and describing the Clark compound metal cutting band saw. Specifications, performance tests and other data are included.

Hydraulic Power Transmissions. The Oilgear Co., Milwaukee, Wis. Bulletin No. 2 describing a line of variable speed oil-pressure power transmission machinery using the Oilgear feed control system.

Forthcoming Meetings

American Engineering Council: Annual meeting Jan. 5 and 6, Washington, D. C. L. W. Wallace is secretary.

Society of Automotive Engineers: Annual meeting Jan. 11 to 13, Engineering Societies Building, New York City. C. F. Clarkson, secretary.

American Society of Civil Engineers: Annual meeting Jan. 18 and 19, Engineering Societies Building, New York City. Charles W. Hunt, secretary.

United Engineering Societies: Annual meeting Jan. 26, Engineering Societies Building, New York City. A. D. Flinn, secretary.

American Institute of Electrical Engineers: Mid-winter meeting Feb. 15, 16 and 17. Engineering Societies Building, New York City, F. L. Hutchinson, secretary.

American Institute of Mining and Metallurgical Engineers: Annual meeting Feb. 20 to 24, Engineering Societies Building, New York City. B. Staughton, secretary.

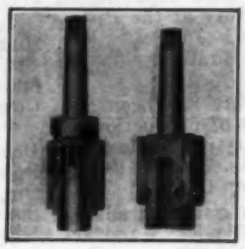
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Drill, Slip-Collet, "Rapid"

American Equipment Co., 5928 Second Blvd., Detroit, Mich.

"American Machinist," July 28, 1921.



Drills, reamers, counterbores and taps may be held in the collets, which can be put in or taken out of the chuck by one hand while the spindle is running, it being necessary only to raise the outer sleeve. There are no projections from the chuck, the exterior being smooth. The main feature of the device is the use of two driving keys. The illustration shows the chuck in both the released and the driving positions. The chuck is made in five sizes, having outside diameters from 1¼ to 3⅝ in. Either blind-head or slotted collets can be furnished, to enable the removal of the drill.

Clamps, Parallel, Toolmakers'

Union Tool Co., Orange, Mass.

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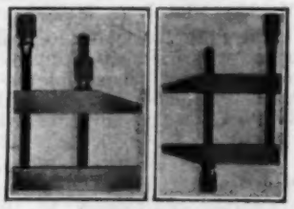
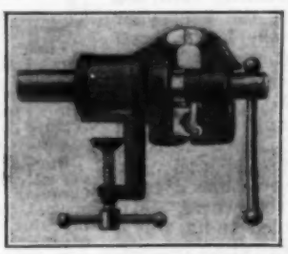


On each clamp the outer screw, which has a step bearing in the lower jaw, is held to that jaw by two steel pins that enter a groove in the end of the screw, thus preventing the latter from slipping out of its bearing and allowing the upper jaw to swing around. One of the clamps is arranged to have both screws project from the same side, so that the lower jaw may be used as a parallel strip. This arrangement enables the toolmaker to set up his work on a pair of parallels and clamp it in place without necessitating the use of extra bolts and straps. All parts are hardened and the straps are ground accurately square and parallel.

Vise, Combination, Special, F & R

Boker Cutlery and Hardware Co., Inc., 101 Duane St., New York, N. Y.

"American Machinist," July 28, 1921

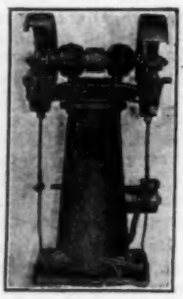


The vise is fitted with two sets of jaws, one being placed on each side of the operating screw. The jaws can be swung about the axis of the screw, so that either set may be at the top or at any angle desired, a locking device holding them in place. The No. 3-S vise has jaws 3 in. wide and capable of opening 3¼ in., while the pipe jaws can hold pipe up to 1 in. in size and round stock up to 1⅛ in. in diameter. A shear blade is placed back of the moving pipe jaw, so that bars up to ¼ in. in diameter can be placed under it and cut by turning the tightening screw. The clamp is suitable for holding the vise on a bench from ⅞ to 3 in. in thickness.

Grinding Machine, Tool, Ball Bearing

The Wheeler Co., Railroad, Pa.

"American Machinist," July 28, 1921.

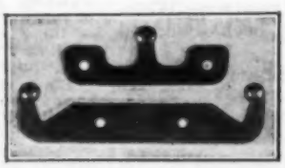


The machine is similar in construction to the polishing machine made by the same concern, its chief feature being the fact that ball bearings are employed for all the running parts; that is, for the spindle, the countershaft and the loose pulley. The machine is made in units, each complete in itself. The head alone can be used on a bench or mounted on the pedestal. The countershaft assembly is mounted at the rear of the pedestal, and is fitted with a shifter operated by means of a pedal at the front of the machine. The head is built in two sizes, one for wheels 10 in. in diameter and 1½ in. thick and the other for wheels from 12 to 14 in. in diameter and up to 2 in. in thickness.

Clips, Card, One-Piece

Detroit Stamping Co., 3445 West Fort St., Detroit, Mich.

"American Machinist," July 28, 1921.



The clips are especially adapted for use where cards have to be changed frequently, as is the case of time cards, stock-bin records, bulletin boards and scheduling boards. They are fastened in place by two screws or tacks and can be used in any position. The holders are ordinarily made of untempered sheet steel. The holding points or lobes are spherically shaped, so that the cards may be easily inserted under them. The style E clip, shown at the top, has but one lobe and is 2 in. in length, while the style C, shown at the bottom and having two lobes or contact points, is 3 in. long.

Hacksaw, Adjustable

Union Tool Co., Orange, Mass.

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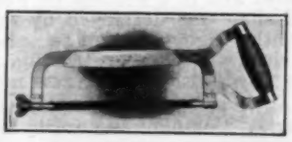
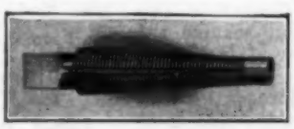


The frame is made of cold-rolled steel of heavy section and the minor parts are steel stampings. The channel which forms the back of the frame is truss-shaped, to withstand the bending strain imposed by too great tension on the blade. The position of the blade enables the operator to secure a firm grip and protects the hand against injury when the piece is cut off. The frame will take blades from 8 to 12 in. in length.

Extractor, Bushing

Conant & Donelson, Conway, Mass.

"American Machinist," July 28, 1921.



The tool is for extracting the soft bushings used in automobile work. It is made of carbon steel and is hardened. A 16-pitch "saw tooth" thread is cut over the entire length of the tapered portion. For extracting a refractory bushing, the extractor is screwed into the bushing a turn or two, and the bushing driven out by tapping on the small end of the extractor with a mallet or soft hammer. The tool can be used to extract bushings from ¼ to 1 in. in diameter.

Gage, Thickness, Feeler

Union Tool Company, Orange, Mass.

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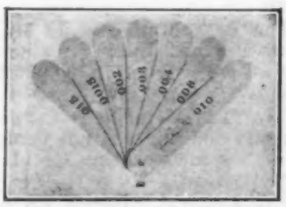

This thickness or "feeler" gage is intended especially for the use of garage repair men. The tool is compactly arranged and is held together by a ring, by which it may be conveniently attached to a key chain, thus enabling the user to carry it in his pocket. There are seven leaves, the thicknesses of which are calculated to provide combinations to any number of thousandths up to 0.043 in. Many half-thousandths combinations may be obtained. The thickness of each leaf is etched upon it in conspicuous figures, so that measurements may be made in comparatively dark places.

Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED SHOPS

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Pa., Hamburg—Hamburg Boiler Wks.—one radial drill.

Pa., Mifflinburg — The Mifflinburg Body Co., manufacturer of auto bodies—presses and other equipment for stamping bodies.

Pa., Philadelphia — Fanning & Schuette Mfg. Co., 502 Ruscomb St.—equipment for machine shop now under construction.

Pa., Philadelphia—The Penn Motor Corp., 1719 North Broad St., H. W. Sofield, Pres. —lathes, boring machines, drill presses, etc.

Pa., Philadelphia—The Sobel Multiplying Bookkeeping Machine Co., 880 North 48th St.—one 14 to 18 in. shaper; one 20 in. lathe; surface grinder; power hack saw and electric tool post grinder.

Fla., Ft. Pierce—The Riverside Garage, E. O. Dennison, Mgr.—one shaper, miller, and burning in machine. Estimated cost, $5,000.

La., New Orleans—The Ideal Auto Co., 641 Baronne St., O. Melancon, Prop.—small or medium sized grinder to grind pistons and valves, valve tappets and transmission shaft (used if in good condition).

Ill., Sibley—The twp. High School Bd. Educ., Dist. 48, W. R. Preston, Clk.—manual training and domestic science equipment.

O., Cincinnati—The Economy Mach. Co., 428 East Pearl St.—one 6 ft. boring mill.

O., Cincinnati—C. Vandevalle, West 6th St. and Mt. Echo Rd., manufacturer of machinery and motor boats—Hill cylinder grinder (used).

Wis., Madison — The Ellwood Tractor Mfg. Co., c/o W. S. Heddler, Assn. of Commerce, Cantwell Bldg.—special machinery for proposed tractor factory.

Wis., Milwaukee — Johns-Manville Co., Inc., 201-31 Clybourn St., G. A. Lindhill, Purch. Agt.—one 30 in. engine lathe, with 16 ft. bed, gear box with 3 in. raising blocks to increase swing to 36 in. and an attachment arm to cut and thread pipe up to 20 in. diameter, one 14 in. lathe with 8 ft. bed, gear box, feed, one No. 2 plain milling machine with gear box, equipped for single pulley, one 4 ft. radial drill with speed box, one 20 in. back geared drill, one No. 2 Universal cutter and tool grinder, one 9 x 9 in., or 8 x 8 in. high speed hack saw, one pipe threading and cutting off machine, capacity 2½-8 in., one pipe threading and cutting off machine, capacity 4-12 in., one 20 in. back geared shaper with gear box, one 26 in. x 26 in. x 12 ft. open sided planer, one 60 in. automatic knife grinder, one No. 2 Universal milling machine with gear box equipped for single pulley, all foregoing to be belt driven; one 14 in. sensitive floor drill with cone pulleys, one No. 3 emery grinder, for wheels 10 x 1½ in., one No. 5 emery grinder for wheels 16 in. x 2½ in.

Wis., Orfordville—O. A. Roen—special machinery for proposed machine shop.

Wis., Peshtigo—Parlow Bros. Co.—machinery and equipment for auto repair shop.

Mo., Joplin—W. LaBarr, 626 Byers Ave. —machine shop tools, including lathes, wrenches, and an air compressor.

Okla., Okmulgee—The Okmulgee Machine Shop, 2nd and Alabama Sts.—one 30 in. lathe with not less than 12 ft. bed, also foundry equipment to handle oil field work.

Cal., San Diego—The City, E. D. Williams, City Hall, Purch. Agt.—one 12 in. independent lathe chuck; one key seating drill for lathe; one Ford coil testing machine; 2 sets ¼ in. to 1 in. stocks and dies; one portable electric drill.

Cal., San Diego—The Independent Electrical Co., 828 7th St., F. L. Edwards, Mgr. —armature winding machine and screw cutting lathe.

Cal., San Diego—The San Diego Machine Co., 743 4th St.—one 2 in. turret lathe to handle 2 in. bar stock, cylinder grinder, crank shaft grinder and piston grinder.

Cal., San Diego—Young & Chamberlain, 1130 Front St.—drill press and air compressor.

La., New Orleans—The Mooney Sheet Metal Wks., 728 Girod St.—small boring machine complete, large size hand groover, shears No. 8 (used if in good condition).

Conn., Bridgeport—Botwinik Bros., 28-42 Drouve St., —$2,500 worth of used woodworking equipment, including planers, jointers, circular saws, band saws, etc., also 5 ton good used belting.

Conn., New Haven — F. L. McDermott Iron Wks., 217 Lafayette St., F. L. McDermott, Purch. Agt.—two 1½ ton chain hoist blocks.

Pa., Philadelphia — The Thull Furniture Co., Trenton Ave. and Dauphin St.—additional machinery including sanders, gang drills and mortiser.

Pa., Pittsburgh — The Pittsburgh Valve Fdry. & Constr. Co., 26th St., along tracks of Allegheny Valley R.R.—one large face grinder.

W. Va.—Huntington — C. A. Love Co., 1145½ 4th Ave—complete circular saw mill.

W. Va., Lowsville—R. Talbott Coal Co.—loading, conveying and other equipment for coal plant.

O., Dayton — The Advance Fdry. Co., Parnell St.—one 24 in. tumbler (used if in good condition).

Wis., Chippewa Falls — The Chippewa Wood Mfg. Co.—wood working machinery.

Wis., Green Bay—Ford Howard Paper Co., South State St.—paper machine and beater.

Wis., Kenosha—The Nash Motor Co., W. A. Gross, Kenosha, Engr.—equipment for private gas plant.

Wis., Oshkosh—F. E. Zuelke, 238 Waugoo St.—ice cream machinery and other refrigerating machinery.

Wis., Milwaukee—The Milwaukee Goodwill Industries, 407 Grove St., O. A. Friedman, Purch. Agt.—automatic fly shuttle rag-rug loom.

Wis., Sheboygan—The Leverenz Shoe Co., 830 Alabama Ave.—special machinery for cutting leather, etc.

Ia., Monticello—The Monticello Tire & Rubber Co.—equipment for the manufacture of tires.

Cal., San Diego—The Coast In Garage, 302 B St., J. E. and M. V. Knapp, Mgrs. —air compressor, motor driven.

Ont., Forest—T. H. Cooke—equipment for ham and bacon curing plant.

Que., Montreal—The Mount Royal Arena, Mount Royal Ave. W., T. J. Duggan, Purch. Agt.—equipment for artificial ice plant.

Metal Working Shops

NEW ENGLAND STATES

Conn., Bridgeport—Union Specialty Co., 138 Hurd Ave., is having plans prepared for the construction of a 2 story, 50 x 125 ft., factory for the manufacture of small metal articles, etc., on Hurd Ave. Estimated cost, $50,000. Private plans.

MIDDLE ATLANTIC STATES

N. J., West Hoboken — J. Keavy, 357 Palisade Ave., has had plans prepared for the construction of a 1 story, 75 x 100 ft. garage on Malone St. Estimated cost, $42,000. McDermott & Binda, 582 Bergenline Ave., Archts.

Pa., Johnstown — The Wharton Motors Co. plans to construct a 3 story motor factory. Estimated cost, $100,000. W. H. Lamborne, Mgr. Architect not selected.

Pa., Sharon—The Wilton Tool Co., 2121 Grand River Ave., Detroit Mich., plans to construct a 100 x 150 ft. plant here for the manufacture of gage blocks, measuring and precision tools.

MIDDLE WEST STATES

Ind., Indianapolis — The Alena Steam Products Co., 208 Hume Mansur Bldg., is having plans prepared for the construction of a 1 story, 60 x 260 ft. truck and tractor factory on Denny Ave. Estimated cost, $45,000. F. Hamilton, 208 Hume Mansur Bldg., Engr.

Ind., Indianapolis—F. R. Chandler, 3817 North Pennsylvania St., is having plans prepared for the construction of a 5 story, 60 x 202 ft. garage at 30-32 West Vermont St. Estimated cost, $250,000. Vonnegut, Bohn & Mueller, 610 Ind. Trust Bldg., Archts.

O., Cleveland — The Cleveland Refrigerator Co., 2996 East 72nd St., has awarded the contract for the construction of a 1 story, 60 x 150 ft. factory and warehouse, at 600 Sideway Ave. Estimated cost, $50.-000. Noted Dec. 22.

O., Lakewood — **(Cleveland P. O.)** — H. Kaplan, 2016 Marlowe Ave., plans to construct a 1 story garage on Madison Ave. near Marlow Ave. Estimated cost, $40,000. Private plans.

Wis., Green Bay — Ford Howard Paper Co., South State St., has awarded the contract for the construction of a 3 story, 100 x 120 ft. machine shop on South State St. Estimated cost, $200,000.

Wis., Madison—The Ellwood Tractor Mfg. Co., c/o W. S. Heddler, Assn. of Commerce, Cantwell Bldg., is having plans prepared for the construction of a 2 story, 60 x 150 ft. tractor factory. Estimated cost, $50,000. Private plans.

Wis., Orfordville—O. A. Roen plans to construct a 1 story, 50 x 90 ft. machine shop. Estimated cost, $45,000. Architect not selected.

WEST OF MISSISSIPPI

Mo., Joplin—W. LaBarr, 626 Byers Ave., is having plans prepared for the construction of a 1 story, 30 x 45 ft. machine shop on 4th St. and Schifferdecker Ave. Estimated cost, $8,000. C. Sudhoelter, 715 Joplin St., Archt.

The Weekly Price Guide

This Week's Market

Pittsburgh mill price of $1.50 on structural steel shapes, plates and bars continues to apply on lots of 100 tons or more; smaller tonnages, $1.60 per 100 lb. Mill shipments, New York, of steel shapes are quoted at $1.88@$1.98; plates at $1.83@$1.98 and soft steel bars at $1.88 per 100 lb. A reduction of $4 per ton is quoted on wire rods and plain steel wire has dropped 35c. per 100 lb. during the week.

Openhearth spring steel is quoted in New York warehouses at 4½c. as against 5c. and light spring steel (base) at 7c. as compared with last week's price of 8c. per lb.

Aluminum ingots, 98 to 99 per cent, are quoted at 19.2c. as against 25.2c. per lb. in less than 15 ton lots.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.50
Northern Basic	22.02
Southern Ohio No. 2	23.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.50
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	23.26
Virginia No. 2	28.74
Basic	20.75
Grey Forge	22.50
CHICAGO	
No. 2 Foundry local	21.70
No. 2 Foundry, Southern, sil 2.25@2.75	24.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	22.46
Basic	20.96
Bessemer	21.96

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.25	3.28	3.10	3.38
No. 12	2.30	3.33	3.15	3.43
No. 14	2.35	3.38	3.20	3.48
No. 16	2.55	3.48	3.30	3.58
Black				
Nos. 17 and 21.	2.85	3.80	3.55	3.95
Nos. 22 and 24.	2.90	3.85	3.60	4.00
Nos. 25 and 26.	2.95	3.90	3.65	4.05
No. 28	3.00	4.00	3.75	4.15
Galvanized				
Nos. 10 and 11.	3.00	4.00	3.75	4.15
Nos. 12 and 14.	3.10	4.10	3.85	4.25
Nos. 17 and 21.	3.40	4.40	4.15	4.55
Nos. 22 and 24.	3.55	4.55	4.30	4.70
No. 26	3.70	4.70	4.55	4.85
No. 28	4.00	5.00	4.75	5.15

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	71	58½	⅜ to 1½	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	1 to 1½	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	60%	46%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	57%	43%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.28
Spring steel (light) (base)	6.00	6.00	3.68
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.53	3.14	3.28
Cold rolled strip steel	6.25	8.25	6.75
Floor plates	4.85	2.64@2.80	5.23
Cold finished shafting or screw	3.55	3.50	3.55
Cold finished flats, squares	4.05	4.00	4.05
Structural shapes (base)	2.78	2.64	2.88
Soft steel bars (base)	2.68	2.54	2.78
Soft steel bar shapes (base)	2.68	2.54	2.78
Soft steel bands (base)	3.28	....	3.48
Tank plates (base)	2.78	2.92½	2.88
Bar iron (2.00@2.10 at mill)	2.68	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
⅜	8.50		12@13
⅛	7.15		11@12
5/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.37½
Tin, 5-ton lots, New York			34.00
Lead (up to carlots), St. Louis, 4.60; New York			5.00
Zinc (up to carlots), St. Louis, 4.97½; New York			5.62½
	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.50	6.75
Copper sheets, base	21.25	22.00	23.00
Copper wire (carlots)	16.50	17.00	16.25
Copper bars (ton lots)	19.75	24.00	19.50
Copper tubing (100-lb. lots)	21.25	24.00	23.00
Brass sheets (100-lb. lots)	16.75	17.00	18.75
Brass tubing (100-lb. lots)	18.50	19.50	20.50
Brass rods (1,000-lb. lots)	14.75	16.00	15.75
Zinc sheets (casks), (8% dis. carlots)	10.50	10.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	21.00	21.50@23.50	19.25
Babbitt metal (best grade)	24.62½	43.75	36.00
Babbitt metal (commercial)	9.87½	13.50	9.00

—Shop Materials and Supplies

MONEL METAL—Base price in cents per lb., f.o.b. Bayonne, N.J.:

Shot	35.00	Hot rolled machined rods (base)	53.00
Blocks	35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold drawn rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grades "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.25	11.50	11.00
Copper, heavy, and wire	11.00	11.00	10.00
Copper, light, and bottoms	9.50	9.00	8.75
Lead, heavy	4.00	3.75	3.50
Lead, tea	3.00	2.75	3.00
Brass, heavy	7.00	6.50	8.50
Brass, light	5.00	4.50	5.00
No. 1 yellow brass turnings	5.75	5.50	5.75
Zinc	3.00	2.50	2.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	19.00	18.50
IX,	20x28, 112 sheets	22.50	21.50	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.75	17.00
IX,	20x28, 112 sheets	20.00	19.50	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	12.00	14.50
IC,	112 sheets	12.80	12.30	14.80
Terne Plate				
mall lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.10
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.72	.77	.74
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per ton		$2.75
Coke, prompt foundry, Connellsville	per ton		3.75

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	—60%	60-10-10%
1⅛ and 1¼x3 in. up to 12 in.	—40%	-60-10-10%	-60-10%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	$4.00 off
Button head bolts, with hex. nuts	—20%	$3.90 net	.....
Hex. head and hex. nut bolts	—20%	.....	-65-5%
Lag screws, coach screws	—50–10%	.....	—60%
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	—50-10-10%	50–5%
Bolt ends, with hot pressed nuts	—50%	.....	—55%
Tap bolts, hex. heads	—20%	.....	.....
Semi-finished nuts all sizes	—70%	—75%	—80%
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ½ in., per 100 lb Off list	$5.00	$5.50	$3.50 net
Washers, cast iron, ⅜ in. per 100 lb. Off list	4.25	3.75	3.50 net
Washers, round plate, per 100 lb. Off list	3.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb Off list	2.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	3.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	-50-10%	60-10-10%	-65-5%
Rivets, tinned	-50-10%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.50	3.50	3 43
Cone heads, ditto (net)	3.60	3.60	3.53
1⅛ to 1¼-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.15	.....	0.15
⅛ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$4.03 base
Copper rivets	—60–5%	—40-10%	—50-10%
Copper burs	—40%	—15%	—10%
Lard oil, pure, (50 gal. bbl.) per gal.	$0.90	$0.85	$0.90
Lard cutting oil (50 gal. bbl.) per gal.	0.60	0.50	0.55
Machine oil, lubricating, per gal.	0.45	0.35	.....
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50–5%	50–5%	50–5%
Medium grade	45%	40-10-2½%	.....
Heavy grade	40%	40%	.....
Rubber and duck:			
First grade	50–10%	50–10%	.....
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	List $9.00 less 20-10-5%	50–10–5%'-20-10%	
Emery paper	List 11.00 less 20%	$11.00 net -20%	
Emery cloth	List 32.75 less 10%	32.75 net -10%	
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll, $4.50 net			list+10%
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	List $1.65 less 20%	.....	-10%
Cloth	List $3.55 less 10%	.....	-10%

Mo., St. Louis—C. Ulman, 4550 Lindell Ave., is having plans prepared for the construction of a 1 story garage at 221 York Ave. Estimated cost, $40,000. P. J. Bradshaw, International Life Bldg., Archt.

Mo., St. Louis—Haynes & Langenberg Mfg. Co., 4045 Forest Park Blvd., has awarded the contract for the construction of a factory for the manufacture of furnaces. Estimated cost, $125,000. Noted Nov. 24.

CANADA

Ont., Brockville—J. R. Baxter Co., Engrs., 102 St. Antoine St., Montreal Que., will soon receive bids for the construction of a factory for the manufacture of electric goods, for E. F. Phillips Electrical Wks., Ltd. Estimated cost, $40,000. Noted Nov. 3.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport—The Nichols Underwear Corp., Inc., 23 Benham Ave., has awarded the contract for the construction of a 2-story, 50 x 100 ft. addition to its factory. Noted June 16.

Conn., South Norwalk—The Norwalk Box Co., North Main and Ann Sts., is having plans prepared for the construction of a 4 story, 60 x 180 ft. box factory on North Main St. Estimated cost, $100,000. Fletcher Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts. and Engrs.

Mass., Webster—Stevens Linen Wks. has awarded the contract for the construction of a 2 story, 70 x 80 ft. addition to its spinning mill. Estimated cost $50,000.

R. I., Pawtucket—The Providence Braid Co., Lowden St., has awarded the contract for the construction of a 2-story, 100 x 105 ft. addition to its braid plant. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J., West New York—P. L. Shultz, Archt., 400 Lewis St., Union Hill, will receive bids until Dec. 31 for the construction of a 1 story, 100 x 150 ft. factory for the manufacture of mirrors, on 13th St. and Park Ave., for S. Denier & Son, 15 Crosby St. Estimated cost, $50,000.

N. Y., Long Island City—The Natl. Printing & Engraving Co., 136 West 52nd St., New York City, plans to construct a 4-story printing plant on Washington Ave., from 6th to 7th Sts. Estimated cost, $400,000. Architect not selected.

N. Y., Utica—A. Scala & Son, 710 Bleeker St., have purchased a site and plan to build a packing plant. Cost between $100,000 to $150,000. Architect not selected.

Pa., Brackenridge—The Atlantic Bottle Co., c/o G. Gander, has awarded the contract for the construction of a 2-story, 100 x 250 ft. bottle manufacturing plant. Estimated cost, $30,000.

Pa., Philadelphia—The Thull Furniture Co., Trenton Ave. and Dauphin St., has awarded the contract for the construction of a 3 story, 18 x 48 ft. furniture factory. Estimated cost, $7,000.

Pa., Turtle Creek—The Wilkinsburg Ice Co., 208 Centre Ave., has awarded the contract for the construction of a 1-story, 85 x 106 ft. ice plant on Monroeville Rd. Estimated cost, $125,000. Noted Dec. 15.

SOUTHERN STATES

W. Va., Wheeling—The White Swan Laundry 30 10th St. will build a 2-story, 50 x 82 ft. and 100 x 200 ft. laundry. Estimated cost, $65,000.

Fla., Osceola (Sanford P. O.)—The Osceola Cypress Co. plans to rebuild its saw mill which was destroyed by fire. Estimated cost, $100,000.

MIDDLE WEST STATES

Ill., Chicago—The Nemo Dye Wks., c/o P. Gerhardt, Archt., 64 West Randolph St., has awarded the contract for the construction of a 1-story, 103 x 115 ft. factory at 4203-07 Grand Ave. Estimated cost, $125,000.

Ill., Henry—The Henry Artificial Ice Co. is having plans prepared for the construction of a 1-story artificial ice plant. Estimated cost, $30,000. C. N. Lucas, Pres. B. L. Hulsebus, 1232 Jefferson Bldg., Peoria, Engr.

Ill., Rockford—Hess & Hopkins Leather Co. will build a 1 story, 60 x 115 ft. tannery. Estimated cost, $40,000. F. L. Morgan, Secy. Noted Dec. 22.

Ill., Rockford—The Nelson Knitting Co., 660 South Wyman St., plans to construct a 3-story knitting factory on Kent St., near Church St. Estimated cost, $75,000. Architect not selected.

Ill., Sterling—The Sterling Canning Co. plans to construct a 2 story cannery. Estimated cost, $45,000. C. M. Sauers, Pres. Architect not selected.

Ill., West Chicago—Reid, Murdock & Co., Clark St. Bridge, has awarded the contract for the construction of a 1-story warehouse and condensing plant. Estimated cost, $40,000. Noted Dec. 1.

Ill., Zeigler—The Zeigler Ice & Bottling Co. will build an ice plant. Estimated cost, $50,000. Noted Dec. 1.

Ind., Frankfort—Royal Cleaners, 12 South Main St., plans to construct a cleaning establishment on West Washington St. Estimated cost, $25,000. R. Leonard, Peoples Life Bldg., Archt.

Ind., Jonesboro—The Indiana Rubber Co. is having plans prepared for the construction of a 3-story, 60 x 125 ft. factory for the manufacture of rubber products. Estimated cost, $50,000. Private plans.

Ind., New Castle—The Indiana Village of Epileptics will receive bids until Jan. 17 for the construction of 14 buildings, including a 1 story, 64 x 100 ft. laundry. Total cost about $400,000. H. Foltz, 843 Lemcke Annex, Indianapolis, Archt.

O., Cleveland—The Whitman-Jackson Sash & Door Co., 1996 West 3rd St., has had plans prepared for the construction of a 1 story, 70 x 128 ft. addition to its factory. Estimated cost, $40,000. H. M. Morse & Co., Plymouth Bldg., Archts.

Wis., Antigo—C. W. Fish Lumber Co., Elcho, is having plans prepared for the construction of a 1-story, 60 x 75 ft. planing mill, here. Estimated cost, $45,000. Private plans.

Wis., Chippewa Falls — The Chippewa Wood Mfg. Co. is having plans prepared for the construction of a 2 story, 50 x 95 ft. factory. Estimated cost, $65,000. Private plans.

Wis., Chippewa Falls—F. Sterzik, Pres. of the Natl. Toy & Tinsel Co., 16th and Hamilton Sts., Manitowoc, is having plans prepared for the construction of a 2-story, 52 x 76 ft. furniture factory here. Estimated cost, $50,000. Private plans.

Wis., Dundas—The Calumet Packing Co., c/o P. H. Peacock, Secy., 309 Michigan Ave., Sheboygan, is having plans prepared for the construction of a 3-story, 50 x 50 ft. canning plant here. Estimated cost, $45,000. W. C. Weeks, 720 Ontario Ave., Sheboygan, Archt. Noted Dec. 1.

Wis., Fond-du-Lac—The Eastern Wisconsin Electric Co., 15 North Main St., has awarded the contract for the construction of a 1-story gas plant. Estimated cost $25,000.

Wis., Fond-du-Lac—The Northern Wisconsin Oil Co., De Pere St., Menasha, has had plans prepared for the construction of a 1 story, 30 x 40 ft. warehouse and a 60 x 60 ft. filling station, on Main and Arndt Sts. Estimated cost, $40,000. Private plans.

Wis., Green Bay—The Fort Howard Paper Co. has awarded the contract for the construction of a 3-story, 100 x 120 ft. paper mill and power house. Estimated cost, $105,000. A. Cofrin, Mgr.

Wis., Green Bay—The Green Bay Investment Corp., 113 West Walnut St., has awarded the contract for the construction of a 3 story, 82 x 240 ft. cold storage plant on North Bway. Esimated cost, $250,000. Noted Dec. 22.

Wis., Green Bay—The Investment Corp. of Green Bay, 113 West Walnut St., will open bids about Jan. 10 for the construction of a 3-story, 80 x 240 ft. cold storage plant on North Bway. Estimated cost, $250,000. L. M. Hansen, Pres. Private plans.

Wis., Kenosha — The Nash Motor Co. plans to construct a private gas plant. Estimated cost, $100,000. Architect not selected.

Wis., Milwaukee—Lockwood Green & Co., Archts., 38 South Dearborn St., Chicago, Ill., is receiving bids for the construction of a 3-story, 260 x 315 ft. tannery at 658 Commerce St., here, for the Amer. Hide & Leather Co., 1320 Elston St., Chicago. Estimated cost, $500,000. G. A. Riker, local mgr. Noted Nov. 3.

Wis., Neenah—The Jersild Knitting Co., 331 North Commercial St., plans to construct a 2-story, 60 x 120 ft. knitting factory. Estimated cost, $100,000. Architect not selected.

Wis., Oshkosh—F. E. Zuelke, 238 Waugoo St., is having plans prepared for the construction of a 2 story, 50 x 54 ft. ice cream factory on Main St. Estimated cost, $40,000. Auler & Jensen, F. R. A. Bldg., Archts.

Wis., Rhinelander—The S. Miller Fruit Co. is having plans prepared for the construction of a 3-story, 50 x 126 ft. warehouse and cold storage plant. Estimated cost, $150,000. Private plans. Noted Nov. 10.

Wis., Sheboygan—The Leverenz Shoe Co., 830 Alabama Ave., has awarded the contract for the construction of a 1 story, 50 x 60 ft. shoe factory on Alabama Ave. Estimated cost, $45,000.

Wis., Sheboygan—The Wisconsin Mirror Plate Co., 20th and Maryland Sts., has awarded the contract for the construction of a 2-story, 60 x 118 ft. factory on Indiana St. Estimated cost, $150,000.

Wis., Wausau—T. G. Kohl Co., recently incorporated, plans to construct a 2-story, 50 x 95 ft. factory for the manufacture of chimney cleaners. Estimated cost, $25,000. Architect not selected.

Wis., Wauwatosa—The Modern Builders Inc., Spring Ave. and Vliet St., will build a 1 and 2 story, 40 x 100 ft. wood working factory. Estimated cost, $50,000.

WEST OF MISSISSIPPI

Ia., Dubuque—The Globe Portland Cement Co. has awarded the contract for the construction of a cement plant, including seven or eight 1- and 2-story buildings, etc. Estimated cost, $2 000,000.

Ia., Monticello—The Monticello Tire & Rubber Co. is building a 60 x 160 ft. tire mill. Estimated cost, $20,000.

Mo., Cape Girardeau—The International Shoe Co., 15th and Washington Sts., St. Louis, is having plans prepared for the construction of a 3-story shoe factory, here. Estimated cost, $100,000. A. Hume, c/o owner, Engr.

Mo., Carterville—The Carterville Fruit & Tomato Cannery, c/o F. L. Gass, Secy., plans to construct a 1-story cannery on Main St. Estimated cost, $5,000. Architect not selected.

Mo., Joplin—The Thomas Fruit Co., 7th and Virginia Sts., is having plans prepared for the construction of a 3-story ice plant on East 7th St. Estimated cost, $75,000. A. Thomas, Pres. C. A. Moore, 646 Plymouth Bldg., Minneapolis, Minn., Archt.

Mo., Monett—W. Frederick is having plans prepared for the construction of a 2 story, 30 x 40 ft. cigar factory. Estimated cost, $10,000. B. Robbins, Monett, Archt.

Mo., Monett—The Hammond Dehydration Co. is having plans prepared for the construction of a 2 story dehydration plant on Bway. Estimated cost, $50,000. Hickenlively & Marks, Landers Bldg., Springfield, Archts.

Mo., St. Louis—J. H. Belz Provision Co., 2035 Gravois Ave., is having plans prepared for the construction of a 4-story, 36 x 46 ft. cooler building at 3601 South Bway. Estimated cost, $40,000. Tait & Nordmeyer Eng. Co., 1107 Clark St., Engrs.

Mo., Sweet Springs—The International Shoe Co., 15th and Washington Sts., St. Louis, plans to build a 2-story factory here. Estimated cost, $75,000. Architect not selected.

S. D., Watertown—Kampeska Materials Co. plans to construct a sand, gravel, washing and screening plant. Estimated cost, $40,000. D. O. Noonan, Pres.

WESTERN STATES

Cal., Calwa—The Pacific Fruit Express Co., 65 Market St., San Francisco, has awarded the contract for the construction of an ice plant. Estimated cost, $52,050.

Cal., Sacramento—A. B. Atkinson, 3256 5th Ave., will build a 1-story, 80 x 160 ft. ice plant on South East 13th and S Sts. Estimated cost, $75,000.

Cal., San Jose—Santa Clara Co. is having plans prepared for the construction of a 3 story addition to its service building, to contain laundry, engine room, cold storage plant, X-ray rooms, laboratories, etc., on County hospital grounds. Estimated costs, $60,000. Binder & Curtis, 225½ South 1st St., archts.

CANADA

Ont., Acton—A. Mason has purchased an old electric power plant and will remodel and equip same as woollen mills. Plans to build an additional story next year. Estimated cost, $35,000.

Ont., Norwich—W. W. Avey plans to construct a planing mill. Estimated cost, $25,000.

Ont., Penetang—Gropp Bros. plan to rebuild their saw mill which was destroyed by fire. Estimated cost, $70,000.

Ont., Petrolea—The Peninsular Sugar Co. has had plans prepared for the construction of a 2- and 4-story sugar refinery, 600 ton capacity. Estimated cost, $1,500,000. F. H. Hubbard, Genl. Mgr.

Vol. 55, No. 26 December 29, 1921 25 cents a copy

American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
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HOWARD CAMPBELL, *Western Editor, Chicago*
MASON BRITTON, *Manager*

CONTENTS

Employment of War-Blinded in the German Industries 1023
BY HUBERT HERMANNS.
SHOWING how the German blind ex-soldiers are employed in production work.
American Machinist, Vol. 55.

Automotive Service Methods and Equipment 1026
BY HOWARD CAMPBELL.
THE FIFTH OF A SERIES of articles dealing with the tools and methods in some of the larger automotive service plants.
American Machinist, Vol. 55.

Tool Engineering 1029
BY ALBERT A. DOWD AND FRANK W. CURTIS.
THE TREATMENT of the subject of turning tools for turret lathes is concluded in this article, which is the thirty-second installment of a series on jig and tool design.
American Machinist, Vol. 55.

Gold-Dredge Bucket and Other Work 1035
BY FRANK A. STANLEY.
A DESCRIPTION of some work of unusual character in shops in the Pacific states.
American Machinist, Vol. 55.

Modern Production Methods—XXV 1037
BY W. R. BASSET.
EXAMPLES OF ACTUAL TIME STUDIES on several different types of machine tools.
American Machinist, Vol. 55.

Some Examples of Fixtures Used on Profiling Machines 1040
BY J. M. HENRY.
THIS ARTICLE SHOWS A FEW of the many jobs to which the profiling machines are adaptable, and examples of practical fixtures in everyday use.
American Machinist, Vol. 55.

Some Operations in Roller Bearing Manufacture 1044
SPECIAL CORRESPONDENCE.
SHOWING A NUMBER of interesting grinding operations, including a large outside grinding job on an internal grinding machine.
American Machinist, Vol. 55.

A Good Example of Push Broaching 1046
SPECIAL CORRESPONDENCE.
DESCRIBES how push broaches can replace the long and expensive "pull" broach on some kinds of work.
American Machinist, Vol. 55.

Ideas from Practical Men 1048
DEVICE FOR GENERATING AN OVAL, DePuy—Boring Bar for Cutting an Inside Relief, Phelps—Rapid Clamping Milling Fixture, Waldo—Indicator Gage for Checking Diameters, Phelps—That Loose Pulley Nuisance Again, Sheldon—Use of Paper in Determining Close Measurements, Haessler—Parallel Double Tongs, Karapetoff—Burnishing Tools for Babbitt Bearings, Owen—Squaring Up a Drawing, Lundquist—Fixture for Pressing Small Bushings Into Connecting Rods, Jordan.
American Machinist, Vol. 55.

Shop Equipment News 1053
BRYANT NO. 2 DOUBLE-HEAD HOLE-GRINDING MACHINE—Murchey Reaming and Chamfering Machines—Lucas Vertical Broaching Press—Stewart Motor-Driven Blower Unit—G. E. Planer Control—Noble & Westbrook Marking Machine—Acme Staybolt Attachment—Natisch Combined Worm and Spur-Gear Speed Transformer.
American Machinist, Vol. 55.

Editorials 1052
KEEP UP TO THE TIMES.
American Machinist, Vol. 55.

Miscellaneous Articles:
The Question of Accuracy in Micrometer Measurements, Rowell 1025
Why Some Good Ideas Don't Work, Bullard 1033
Notes on Worm-Thread Formulas, Fredericks 1043
Reminiscences of an Old-Time Machinist, Huntington 1047
American Machinist, Vol. 55.

Searchlight Section 113

Contract Work 121

What and Where to Buy 124

Advertising Index 136

Coming Features

Our next issue, the first of 1922, will be devoted to pointing out sources of wastes and indicating ways and means of cutting costs.

Men who are very well qualified have written on the subjects: Use of cost figures, oil conservation, simplification of product, cost of industrial accidents, salvaging industrial wastes, coal costs, power plant costs, maintenance of electrical equipment, economy in the use of small tools, the value of safety, and others.

News Section 1058

The Business Barometer 1058b
BY THEODORE H. PRICE.

Weekly Price Guide, Shop Materials and Supplies 1058j and k

New and Enlarged Shops 1058i and l

JAMES H. McGRAW, President · ARTHUR J. BALDWIN, Vice President · J. MALCOLM MUIR, Vice President · EDWARD D. CONKLIN, Vice President · JAMES H. McGRAW, JR., Secretary and Treasurer

McGRAW-HILL COMPANY, INC., Tenth Ave. at 36th St., NEW YORK

Publishers also of Electrical World—Electrical Merchandising—Power—Engineering News-Record—Engineering and Mining Journal—Chemical and Metallurgical Engineering—Electric Railway Journal—Coal Age—Journal of Electricity and Western Industry—Ingeneria Internacional

Annual subscription rate, $5 in any part of the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Dominican Republic, Honduras, Salvador, Nicaragua, Peru, Colombia, Bolivia and Shanghai, China. Extra postage on American Edition in foreign countries except Europe and British possessions in Eastern Hemisphere, $4 (total, $9 or 38 shillings). Single copy 25 cents. McGraw-Hill Publishing Co., Ltd., 6 Bouverie St., London, E. C. 4, England, will serve with the European Edition only all subscribers in Europe and British possessions in Eastern Hemisphere (40 shillings for England and 45 shillings elsewhere in Eastern Hemisphere.)

WASHINGTON, D. C., Colorado Building
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LONDON, E. C., 6 Bouverie St.

Cable Address: "Machinist, N. Y."

Circulation of This Issue, 19,860

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Copyright, 1921, McGraw-Hill Company, Inc.

Published weekly.

Entered as second-class matter June 23, 1879, at the Post Office at New York, under the Act of March 3, 1879.

Printed in U. S. A.

Member Associated Business Papers, Inc.
Member Audit Bureau of Circulations.

WHO'S WHO

MR. JOHN ROY PORTER

ROY PORTER, General Manager of Marshall & Huschart Machinery Company, was born in Oxford (not England) Ohio, December 7th, 1874.

After going through the public schools there, he served his apprenticeship at the Niles Tool Works, Hamilton, Ohio.

He worked for the Hamilton Machine Tool Company for seven years, and then became associated with the Marshall & Huschart Machinery Company, with which concern he has been for seventeen or eighteen years, working up to his present position as General Manager.

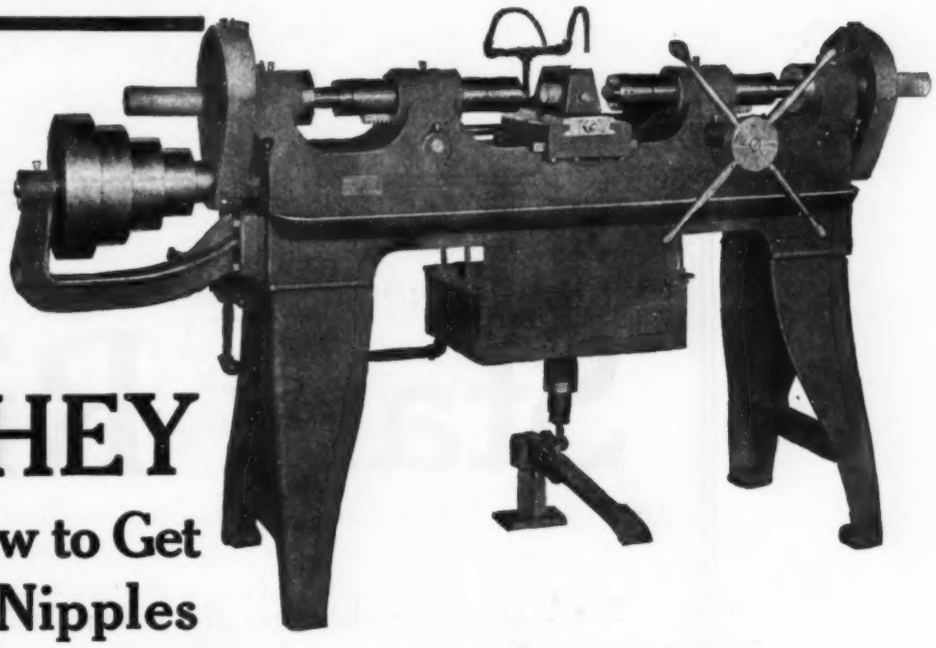
In addition to this position, he is President of the Machine Tool Dealers' Association of Chicago, President of the Machinery Club of Chicago, Director of the Employers' Association of Chicago, and President of the Machinery Transport Company of Chicago.

He is a member of the Illinois Athletic Club, the Colonial Club of Oak Park, Ill., the Western Ho Golf Club of Oak Park, the Oak Park Lodge A. F. & A. M., the Oriental Consistory, 32nd Degree, and the Mystic Shrine Medinah Temple A.A.O.N.M.S. of Chicago.

Next to that boy Paul of his (age twelve) he is proudest of his accomplishments on the golf course, especially when he visits Cincinnati.

He is one of the few men in the machinery line that Prohibition did not affect, as he has always been an absolute teetotaler. But he makes up for it by his long black cigars, which he constantly smokes.

Roy Porter is an open-natured, up-standing man, strictly on the square.



MURCHEY

Shows You How to Get Chamfered Nipples of the Highest Quality at a Low Cost

Murchey has gone and done something different again. Brought out an entirely new Nipple Reaming and Chamfering Machine that does what no one has ever tried to do before.

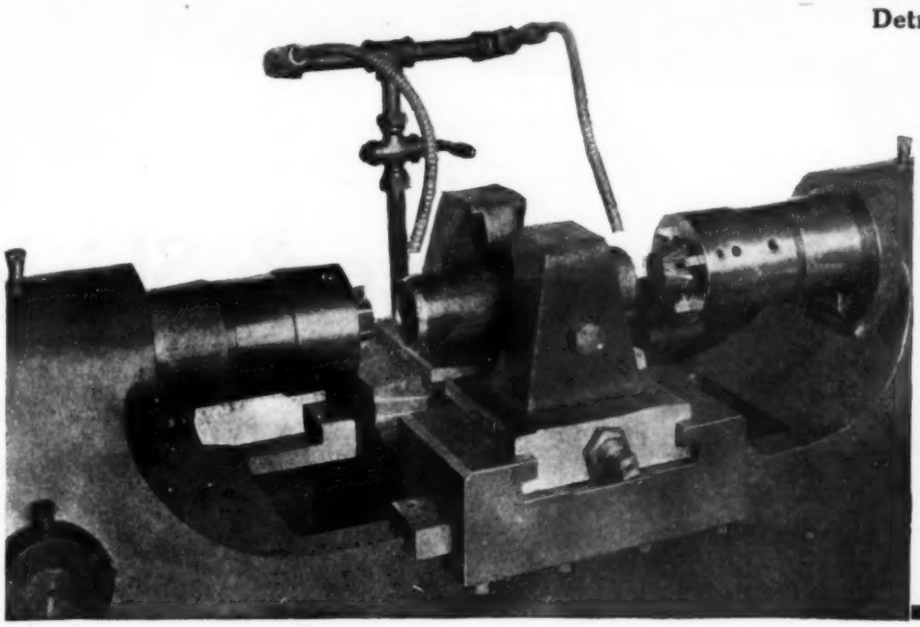
Lots of people have been clamoring for chamfered nipples of better quality. Nipple producers inform us that this new Murchey Reaming and Chamfering Machine produces such nipples at a lower manufacturing cost than it now takes to produce inferior nipples.

You know, on a threading machine the reaming and threading are done in one operation. This causes an undue strain on the dies and means a constant repairing and replacing of dies and die parts. Manufacturing costs as a result are necessarily increased.

Now on this new Murchey Machine you do the reaming and chamfering as one operation and the thread cutting as a separate operation. "But this increases the number of operations," you object. Yes, but it turns out BETTER nipples and *does it so rapidly* that the production cost is LOWER than by the present established method. A conservative estimate of the output is 650—¾ inch or 350—1½ inch reamed and chamfered nipples an hour.

You will certainly want to know more about this machine—how it operates and whether it is adapted to any other uses. So write for the Bulletin—it shows what a simple proposition it is.

Murchey Machine & Tool Co.
Detroit, Mich.



A close-up of the Murchey Nipple Reaming and Chamfering Machine. Capacity ½ inch to 2 inch pipe. Lengths, close nipple to 12 inch length. Note the stability of the chuck.

LATHES
Good Lathes Only

Start Right!

That's the thing—the start! If it is right, half what you intend to do is accomplished.

Years ago the French attempted to cut a canal through the Isthmus of Panama. They failed because they did not get started right. The equipment and methods used were entirely inadequate and that made the job appear almost impossible. If they had started right, with correct equipment, there is every reason to believe they would have succeeded.

The New Year is here. It's the time to make good resolutions. Start the New Year with the firm intention of keeping production costs to a minimum and YOU WILL.

Make up your mind now to be rid of all machinery that does not cut the *cost per piece* to the bone.

Investigate and get facts from manufacturers who have already invested in machinery that keeps the *cost per piece* from soaring. See what they have to say!

The Lodge & Shipley
Cincinnati,

LATHES
Good Lathes Only

LATHES
Good Lathes Only

The Lodge & Shipley Manufacturing Lathe

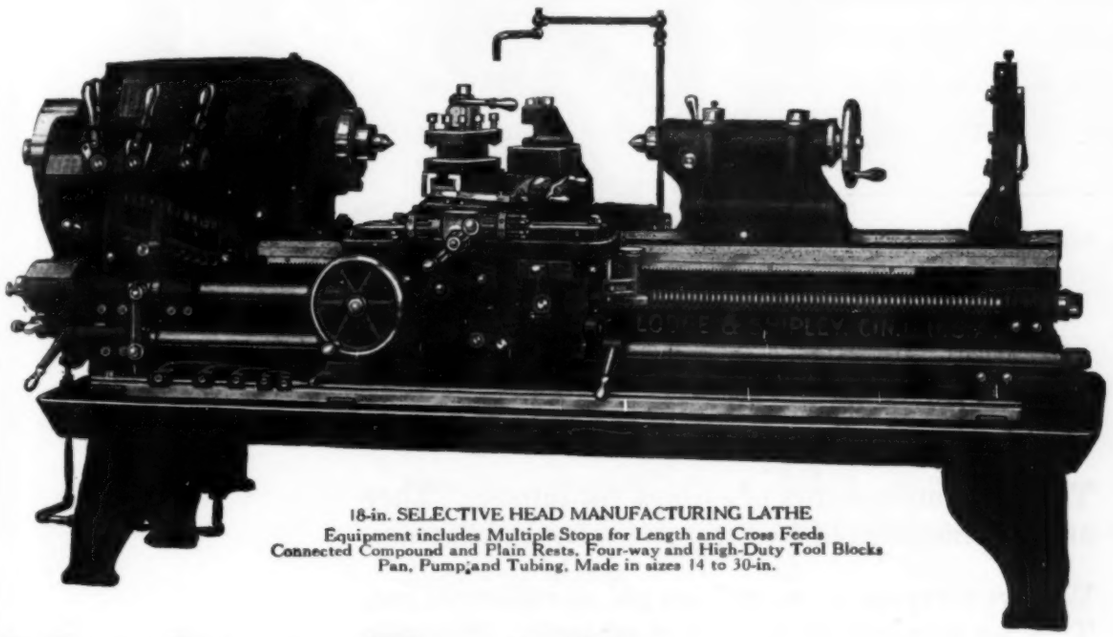
is one machine you can count on to keep your production costs down. Twenty-five to fifty percent of the time taken to turn duplicate pieces of work on the ordinary lathe can be saved by it.

And this is not just theoretical, it actually occurs!

With this timesaving it is possible to maintain a high standard of accuracy. The one big thing about this machine is, while it offers the advantages of the automatic, it retains its function as a single purpose tool. Standard lathe tools are always used,which of course means another big saving.

This lathe was designed to cut the *cost per piece* on duplicate work and *it does*. Not only do we say this, but hundreds of manufacturers now using it tell us so.

Start the year RIGHT—cut down the *cost per piece*. Send for literature.

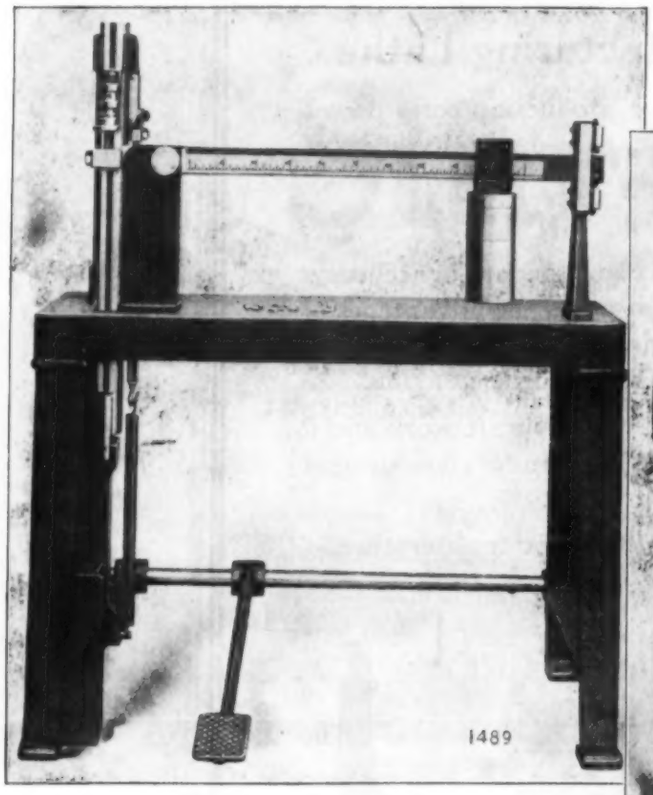


18-in. SELECTIVE HEAD MANUFACTURING LATHE
Equipment includes Multiple Stops for Length and Cross Feeds
Connected Compound and Plain Rests, Four-way and High-Duty Tool Blocks
Pan, Pump and Tubing. Made in sizes 14 to 30-in.

Machine Tool Co.
Ohio

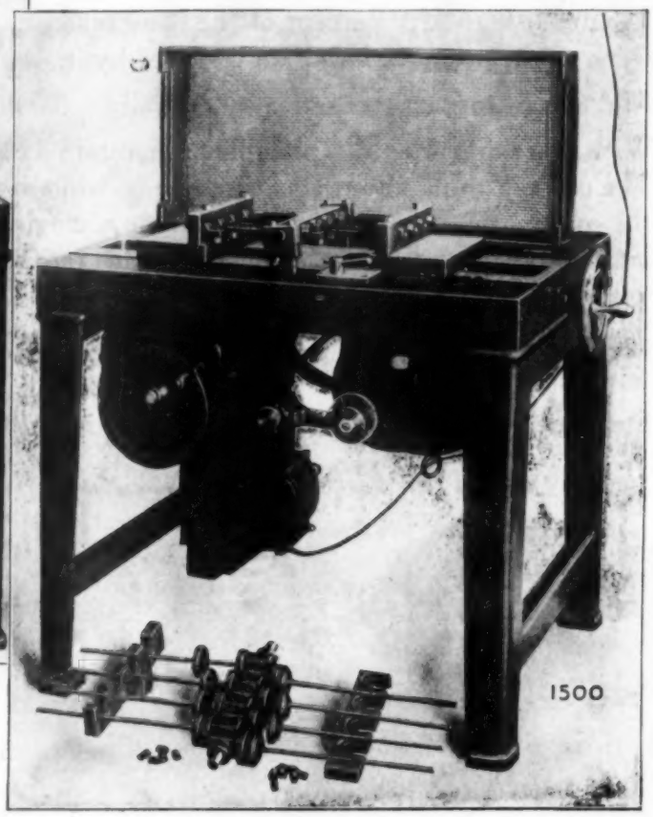
LATHES
Good Lathes Only

Some refinements in manufacturing CINCINNATI MILLERS



Weighing machine for measuring the strength of springs

Fatigue test for loaded springs



Spring Reliability

Take the simple matter of springs, for instance. They are vital members in feed trip and safety mechanisms.

We give every one a "weigh" test and an endurance test. Thus we eliminate all those that are unfit. This may seem like needless refinement. We consider it important because it increases dependability.

Investigate Cincinnati details before you buy a Miller.

The Cincinnati Milling Machine Co.
Cincinnati, Ohio

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI **OHIO**

Why do you use Case-hardened Parts?

Foolish question? Not if the Carbonizing is done in short-life containers that grow, warp, crack and change in other ways that interfere with uniform heat penetration or cause soft spots. Soft spots not only defeat the purpose of case-hardening but add to the cost.

Cast Nichrome Containers and furnace parts are used in Carbonizing for the same reason as case-hardened parts are used in machinery—for efficiency, for service, for economy.

Service records of Nichrome Castings at 1800° F. reach into thousands of hours. The proof is in hundreds of plants. Your economy is doubly assured by the Nichrome guarantee. Booklet N-21 tells more about this high-temperature Alloy, Nichrome, and shows Cast Nichrome stock patterns in hundreds of sizes.

Manufactured under HENDERSON Patents by

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY
Chicago - Detroit - Canada - England - France

A Difficult Problem—
Solved with a Landis Threading Machine

THIS material, as the man in the shop would say, "is funny stuff." It is quite hard, yet so tough that a lot of hammering only bends it a little. Given enough power and one of these pieces can be tied in a knot, yet it won't break. It is the stuff that is put into airplanes.

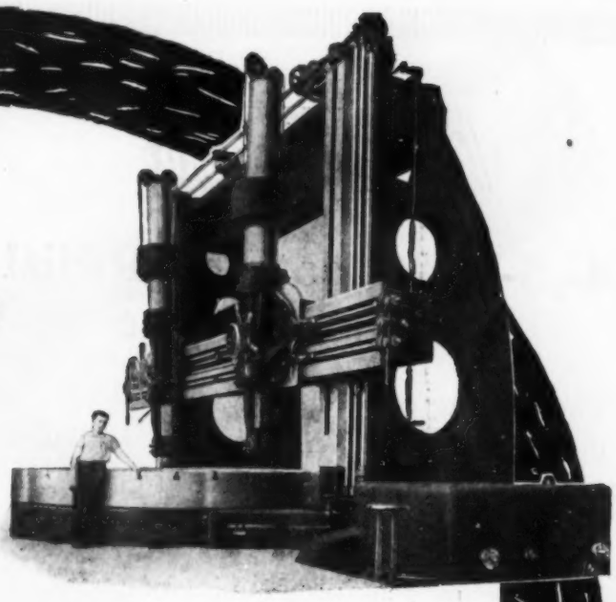
Imagine trying to thread it on a quantity-quality basis. The superintendent here tried it without success, until the Landis Threading Machine arrived. That was over a year ago, and now all's changed; the work proceeds without a hitch. There are 24 threads per inch, diameter is 5/16 in., and length of thread 5/8 in. Approximately 3,000 pieces are turned out each eight hour shift.

Get the Catalog

Landis Machine Company, Waynesboro, Pa.

LANDIS

HEAVY BETTS DUTY



Here is a Point Worth Thinking About

If a Boring Mill has just strength enough to do a job of the swing and weight capacity of the Mill it will not do a good job.

It is not the strength in a Boring Mill that will give good satisfaction.

It is *rigidity*

By rigidity we mean that the tool should be backed up by sufficient mass so that it will not vibrate.

As soon as a machine begins to vibrate you will not be able to turn out the proper class of work.

Betts Tools have **rigidity** to the limit of their capacity.

Planers
Boring and Turning Mills
Engine Lathes
Axle Lathes
Journal Truing Lathes

Send us Your inquiry

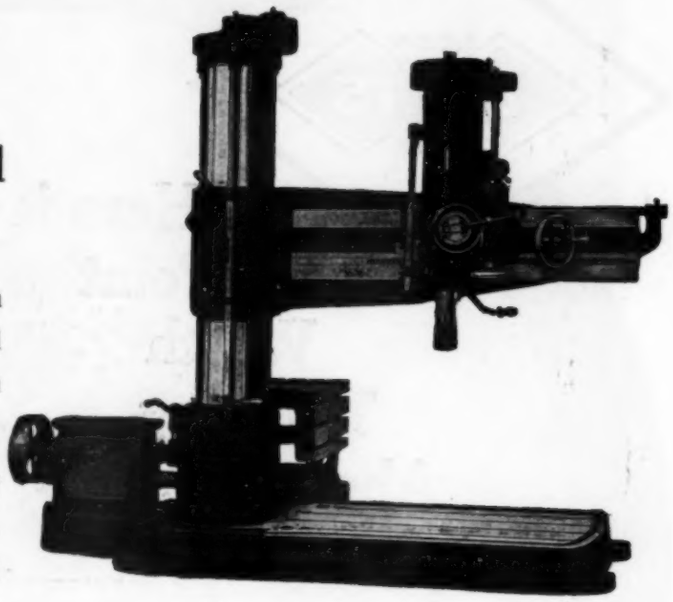
Betts Machine Company
402 Blossom Road, Rochester, N. Y.

Horizontal Boring, Drilling and Milling Machines
Tire Turning Mills
Car Wheel Borers
Slotters, etc.

BETTS MACHINE TOOLS

THE CINCINNATI BICKFORD

4-, 5-and 6-foot Plain Radial Drilling Machine



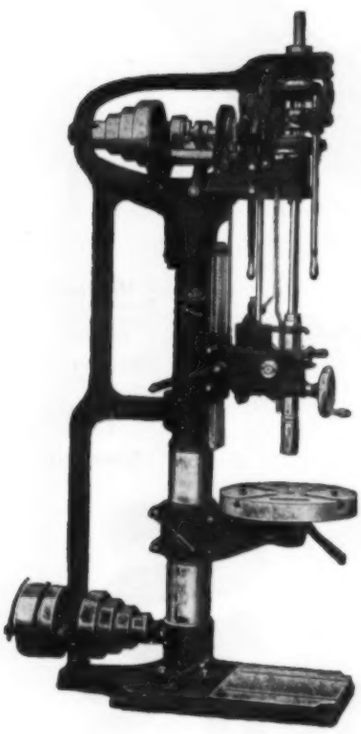
The growing value of time can be traced in the evolution of *Cincinnati Bickford* Radial Drilling Machines from their original form to their present highly developed types.

This machine requires a minimum number of operations in drilling a hole. Those operations that are required have been developed so as to take a minimum amount of time—one result of our years of experience and concentrated effort.

The Cincinnati Bickford Tool Company

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874



THE CINCINNATI

Gives You the Benefit of 48 Years' Experience

We have been manufacturing drills for over forty-eight years. The refinements of design and construction that characterize our machines come as a result of great care and much costly experimentation on our part. Every user of a *Cincinnati profits by our experience.*

The machine shown is our 21-inch, Sliding Head, Heavy Pattern Drill. The Patent Geared Tapping Attachment is furnished or not as desired. These drills have many excellent features that will help reduce your drilling costs.

No. 6

For Either Hand or Machine

Geometric Solid Adjustable Tap

Right on the Lead

Here's the threading tool that is "making good" in the reduction of producing costs—the **Geometric Solid Adjustable Tap.**

It is especially valuable on machines having no means of closing a Collapsing Tap or for some other reason not permitting the use of a Collapsing Tap.

The Geometric Tap has the advantage of use either as a hand tap or as a machine tap.

The Tap is not equipped with the collapsing device, but has all the other advantages of a Collapsing Tap. Being adjustable, correct size is always maintained.

Chasers are readily removed for regrinding, and when finally necessary to renew the chasers, this can be done at slight cost. A great saving over renewing the entire tap.

Each size tap accommodates chasers for a range of diameters.

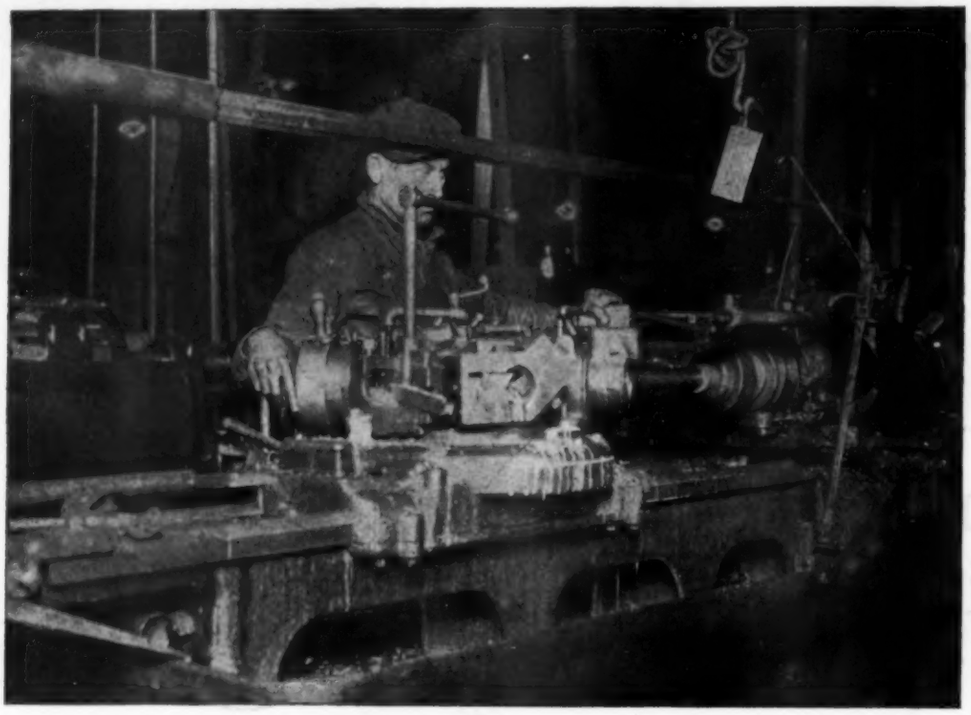
Reducing production costs is no new occupation for Geometric Screw Cutting Tools and Machines.

Let us prove it.

The Geometric Tool Co., New Haven, Conn., U. S. A.

Chicago Office, 627 Washington Blvd.

HARTNESS FLAT



Speed Up Production

TRUE speed for the purpose of increasing output does not consist in the undue hurrying or overworking of the machine tool operator. On the contrary, it means saving the operator all unnecessary effort and false moves by providing such convenient control that the machine will be operated at its maximum efficiency under all conditions.

The Hartness Flat Turret Lathe fully meets these requirements for greater production by reason of its centralized control, positive quick feed changes and friction speed changes.

The operator of a "Hartness" readily selects any desired speed or feed while the machine is running under cut, without changing his working position or even slowing down the machine. That is why the "Hartness" can and will speed up production in your shop. It is also the reason why the "Hartness" is the standard for quantity as well as quality production in railroad shops throughout the country.

JONES & LAMSON

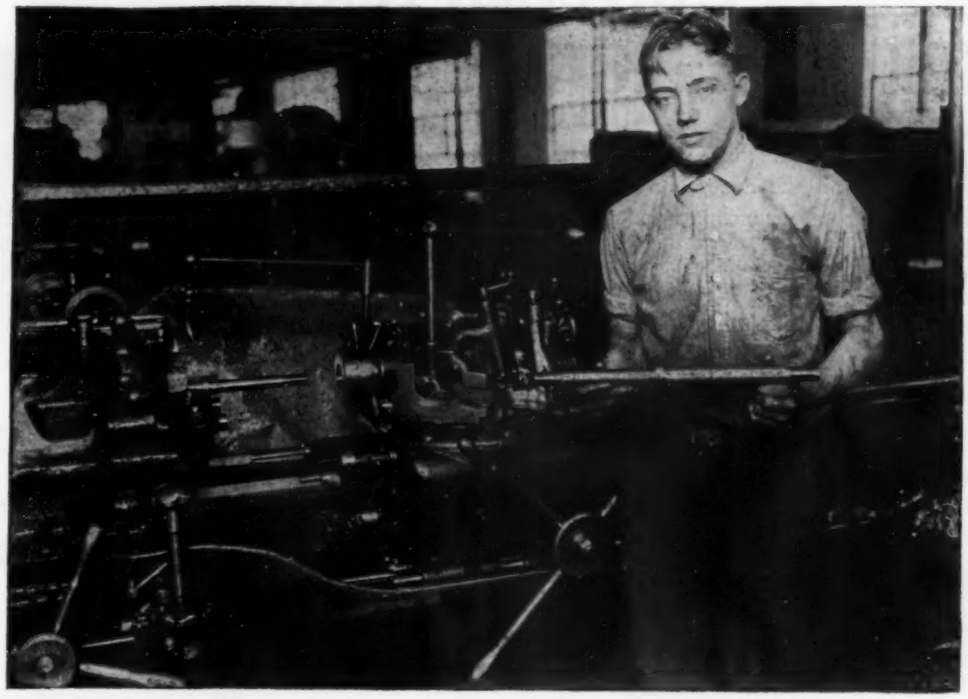
Springfield, Vermont, U.S.A.

France, Spain and Belgium—F. Auberty & Co., 182 Rue Lafayette, Paris

Holland—Spliethoff, Beeuwkes & Co., Leuehaven, wz 159 Rotterdam.

AGENTS

TURRET LATHES



Increase Economy

NOW is the time to avail yourself of the opportunities for greater and more economical production offered by the Hartness Flat Turret Lathe. There is no better way to meet the present demand for economy in your particular shop, than by installing Hartness Flat Turret Lathes to handle the innumerable chucking and turning jobs that come within their range.

Whether it be the regular routine class of work such as the threading of bolts as shown in the illustration at the left, or the unusual or unexpected job such as machining the emergency valve stem shown on the right hand page, you'll find the "Hartness" always ready to turn out a first class job in a hurry and at minimum cost.

Let us explain in detail how a "Hartness" will boost production and cut the costs in your shop.

Write today for full information.

MACHINE COMPANY

9-10 Water Lane, Queen Victoria St., London, England

Japan, Korea, etc.
Mitsui & Co., Ltd., Tokio

Australasia—McPherson's Pty., Ltd.,
554 Collins St., Melbourne

Sweden—A. Bol. Oscar Lindbom,
Stockholm—Post Box 420

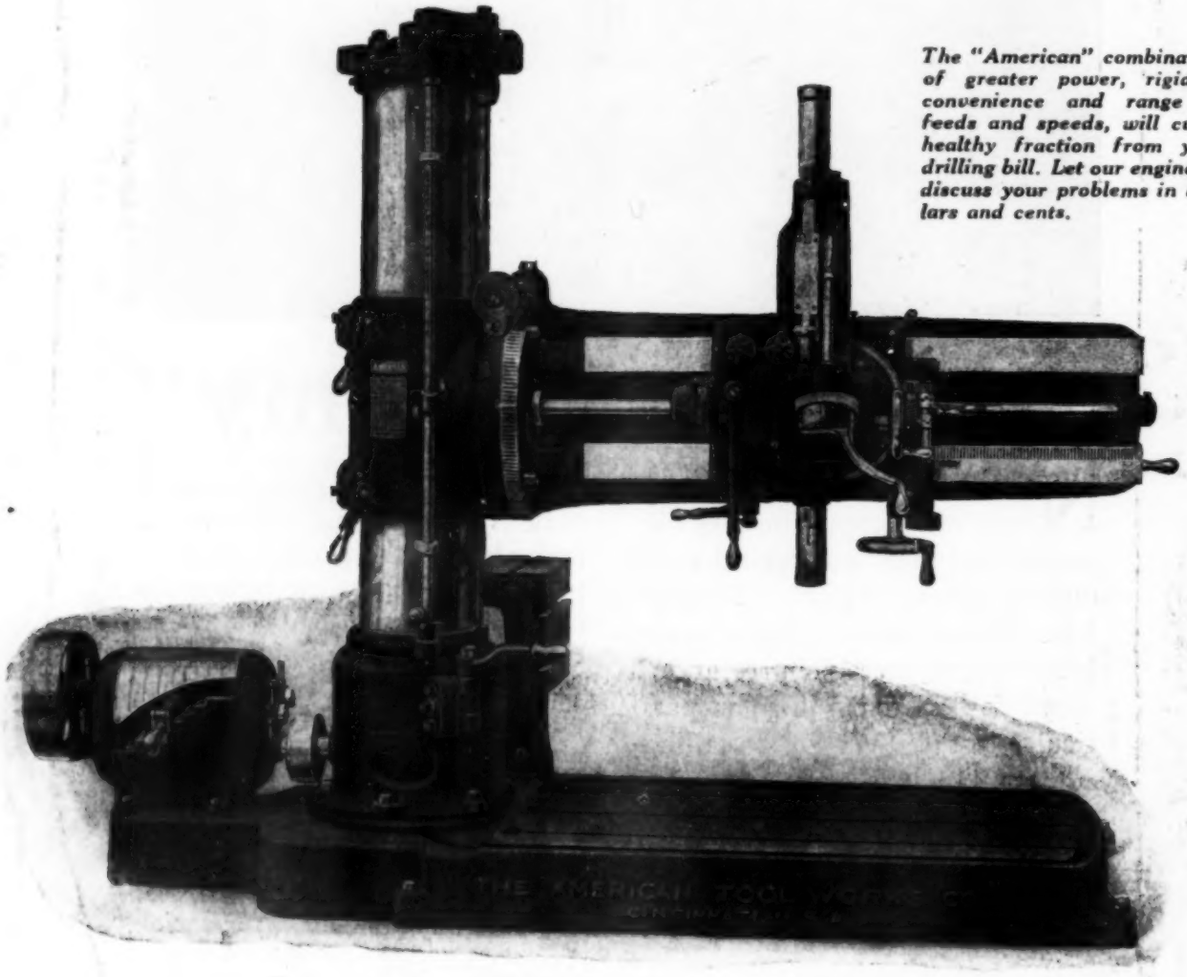
AMERICAN

A Universal Radial Built to Stand Gruelling Service

Suppose that reputable engineers announced that in one machine they had combined all the adaptability of the finest Universal Radial, with the staunchness and power of the world-famous AMERICAN Triple Purpose RADIAL!

Wouldn't you at least put their claims to the test—knowing what a trouble-proof "Universal" would mean in hole-production?

Below is a picture of such a machine—on the opposite page is a story of what it can do. This machine doesn't need to step back for any plain-arm Radial when a severe job comes along. Its distinctive design enables it to hold its own with the best high-speed steel under any conditions.



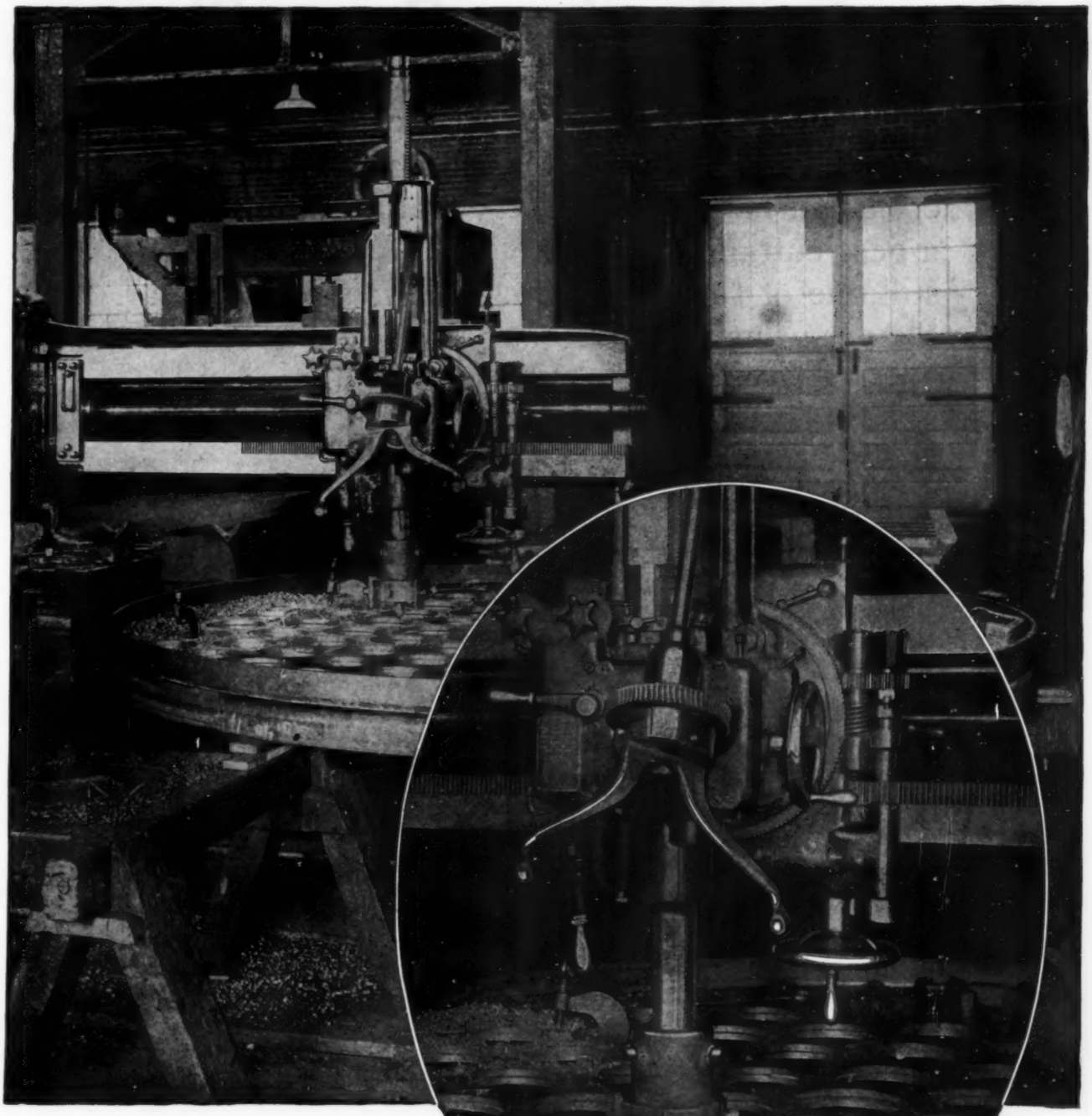
The "American" combination of greater power, rigidity, convenience and range of feeds and speeds, will cut a healthy fraction from your drilling bill. Let our engineers discuss your problems in dollars and cents.

The American Tool Works Co.,

Lathes *Planers* *Shapers*

One Hole Every Four Minutes

The photographs show a 6-ft. "American" Universal Radial trepanning 8-inch holes in condenser heads one inch thick. One hole complete every four minutes, is the production schedule—every hole clean-cut and tool breakage practically eliminated.



Cincinnati, U. S. A.

Radials

CUT GEAR COSTS

with the

New Production Gear Shaper

The new production Gear Shaper, illustrated on the opposite page, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result; and still one of the outstanding features of the Gear Shaper principle—accuracy has been maintained.

It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

See illustrated articles in all technical magazines.

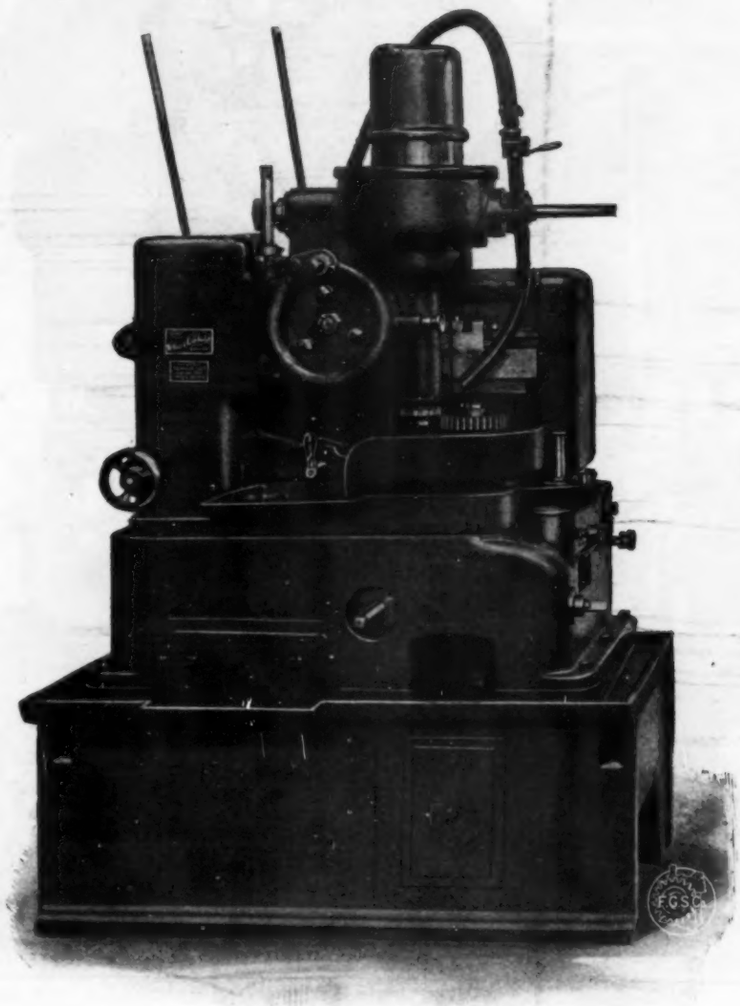
Send for our booklet "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now. Address:

The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

The New Production Gear Shaper, which operates at sewing machine speed, and cuts gears of great accuracy—representing the greatest advancement in the art of gear cutting in the past 20 years.

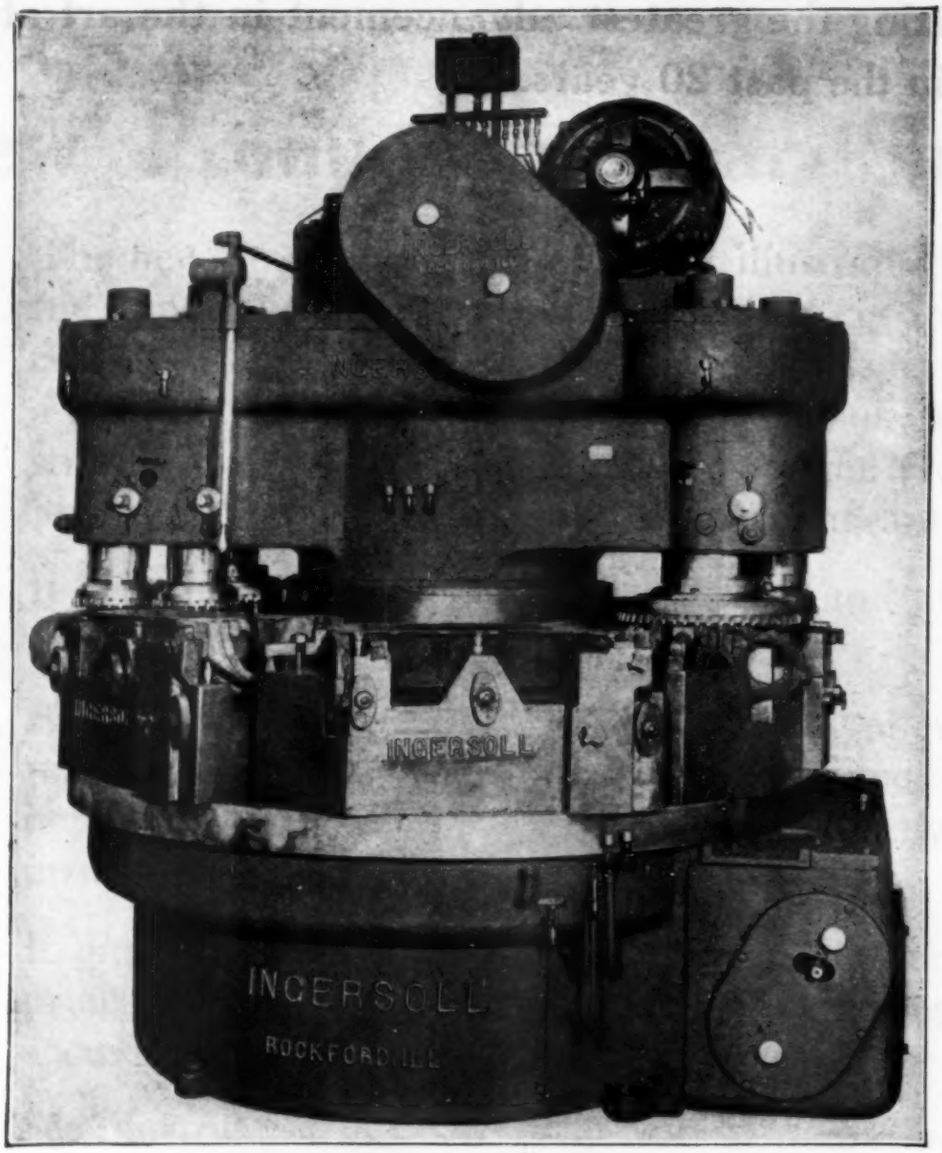


The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

Foreign Agents: Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India), Ltd., Head Office, Calcutta, India.
Pacific Coast Representatives: Eccles & Smith Company, Portland, Oregon; Seattle, Washington; San Francisco and Los Angeles, California.

INGERSOLL



Milling Crank Cases on a Circular Ingersoll Continuous Milling Machine

The bottom surface of the crank case of a four cylinder motor is milled on a Circular Ingersoll Continuous Milling Machine. The machine is equipped with two sets of spindles. Each set consists of two roughing spindles and one finishing spindle.

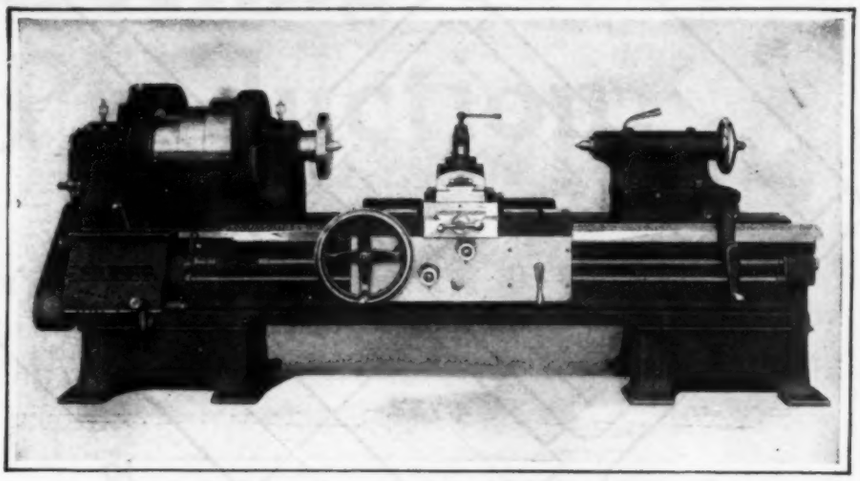
There is a loading station on each side of the machine between the two sets of spindles. Each station is tended by an operator, who keeps watch of one set of spindles and replaces the castings finished by them with rough ones which will be machined by the other set of spindles. At each revolution of the table twelve finished castings are produced, two from each fixture.

This is truly a Continuous Milling Machine in that the operators can in no way affect the relative position of the fixtures, nor can they delay the steady production of the machine. Working on an 85% efficiency basis, this machine, running with a 15-inch feed, produces 375 finished castings in an 8-hour day. It is equipped with a 30 H.P. motor, and weighs 33,000 pounds.

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

Detroit: David Whitney Bldg. ROCKFORD, ILLINOIS 50 Church St., New York



FLATHER 24 in. Double Back Geared Lathe

FLATHER

Take the First Step With Care and the Journey Will Be Easy

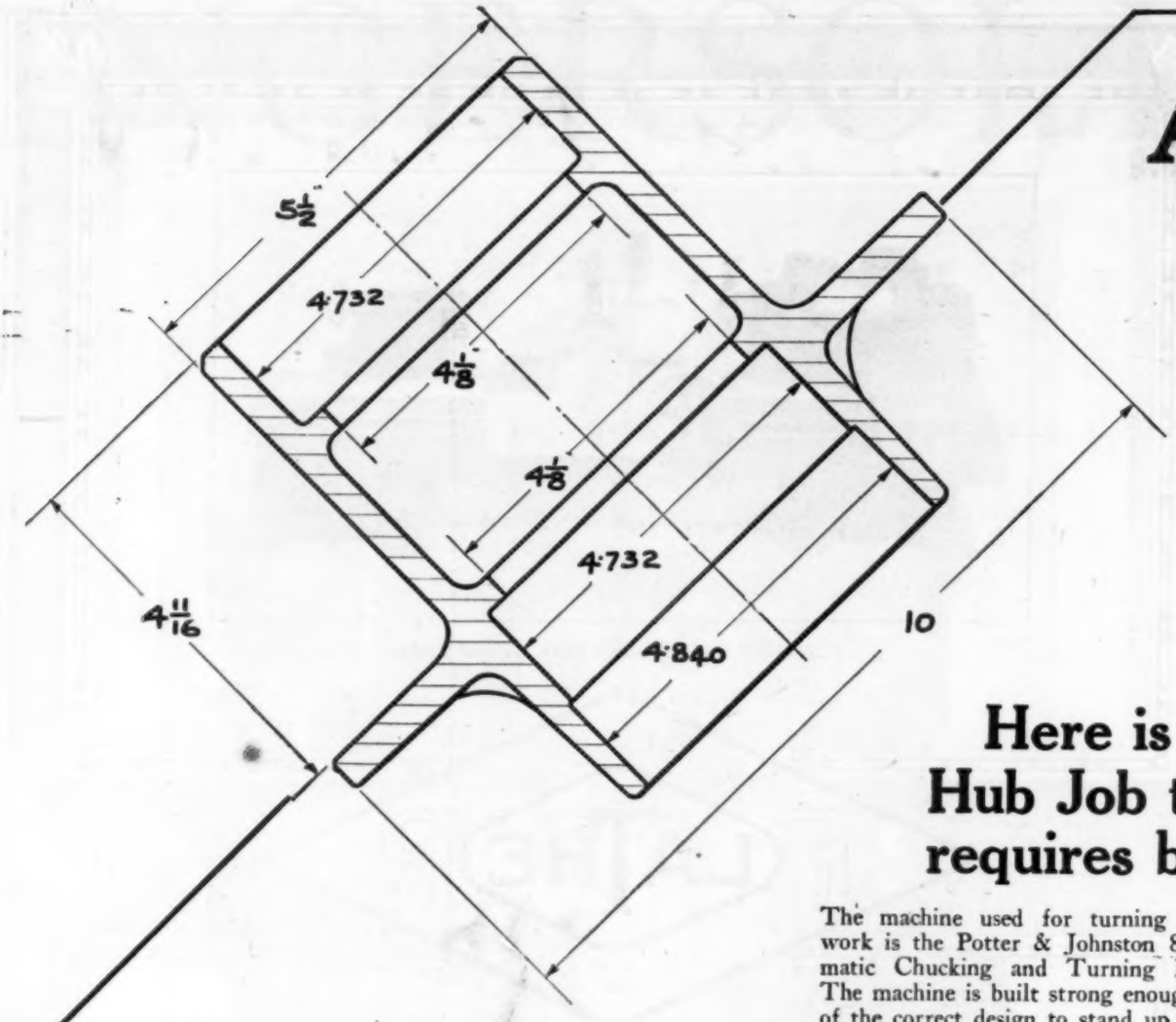
Commonplace equipment promises a troublesome manufacturing journey. Constant supervision, repair losses, time out —all are obstacles to comfortable profit.

Flather Lathes assure the acme of satisfaction. We have designed one for each of your particular needs and feel confident that it will do your work a little better.

It has in every other instance.

Let us tell you about it.

Flather & Co., Inc., Nashua, N. H.



Are

Here is a Hub Job that requires both

The machine used for turning out this work is the Potter & Johnston 8B Automatic Chucking and Turning Machine. The machine is built strong enough and is of the correct design to stand up and produce all that is required both for accuracy and production.

The Hub which is made of malleable iron is completed in two holdings, no further operations being required, as all dimensions are to size:

First Holding

1st T. F.—Rough Bore, Turn and Face Flange
2nd T.F.—Finish Bore, Turn, Face Flange and Chamfer Hub
3rd T. F.—Ream 4.732 diam.

Second Holding

1st T. F.—Rough Bore, Turn and Face Hub
2nd T. F.—Finish Bore, Turn, Face and Chamfer Hub
3rd T. F.—Ream 4.732 diam.

Output per machine is:

First Holding—86 per day of nine hours.
Second Holding—86 per day of nine hours.

One attendant operates three machines on this class of work

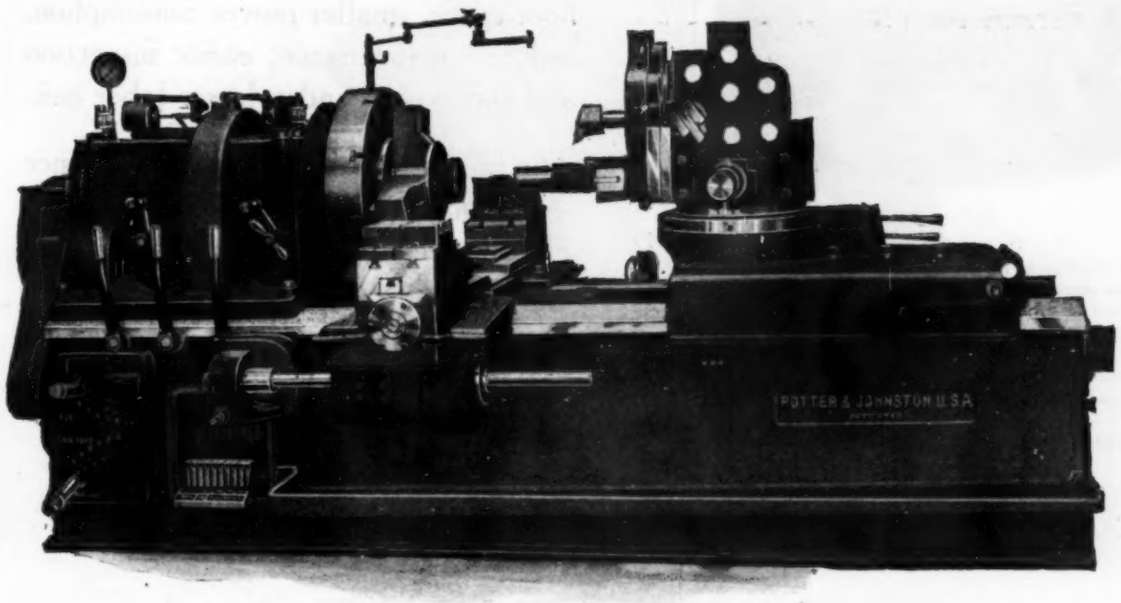
New York Office: Hudson Terminal Bldg., 50 Church Street, Walter H. Foster, Manager. Detroit Office: The Potter & Johnston Agency Co., 535 Bates St. Chicago Office: 1001 McCormick Bldg., Chas. H. Shaw, Manager. Pacific Coast Offices: Title Insurance Bldg., Los Angeles, 75 Fremont St., San Francisco, Louis G. Henes, Manager. Toronto Office: 11 Wellington Street, East, E. C. Roelofson, Manager.

POTTER &
PAWTUCKET,

You Getting Accuracy with Production?

If *you are getting both* you may be interested in a way of improving your present method of machining and thereby jumping up your production and at the same time retaining your accuracy.

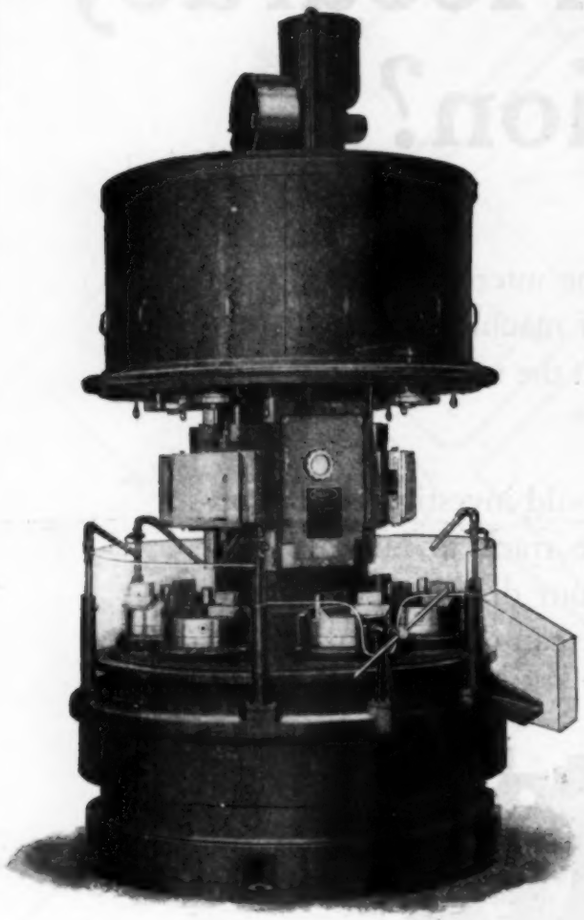
If *you are not getting both* you should investigate the proposition right away and get on the track to improve your methods of manufacture. Send your drawings or samples along and we will outline what we can do for you.



JOHNSTON
RHODE ISLAND

Foreign Offices and Representatives: Office for Great Britain, France, Italy, Belgium, Switzerland, Spain and Portugal: Potter & Johnston Machine Co., 68 Ave. de la Grande Armee, Paris, France, J. Ryan, Manager. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester and Newcastle-on-Tyne, England, and Glasgow, Scotland. Ercole Vaghi, Corso Porta Nuova, 34 Milan, Italy. Rylander & Asplund, Stockholm, Sweden. Yamatake & Company, No. 1 Yurakucho, Ichome, Kojimachiku, Tokyo, Japan.

When You Talk of Profits



Earned by Savings in Cost, You Will Find No Better Example Than

MULT AU-MATIC Economy

Figure your present costs on chucked work down to bed rock—cut the last minute of excess time from your operations—then get a complete report of Mult-Au-Matic economy on your work.

Mult-Au-Matic costs show a saving in floor space, smaller power consumption, reduced maintenance, easier inspection and supervision and a lower labor cost.

The processing of all operations at once—the longest cut in the shortest time and all other cuts in the same time—and the automatic indexing of the machine which paces the operator in chucking the work, insures consistent continuous production.

Mult-Au-Matic Economy in two recent installations shows the following comparisons of Unit Production Cost.

Former Method	0.283	0.422
Bullard Method	.064	.187
SAVING PER PIECE...	0.219	0.235

If you can meet competition by other methods you can Make Profits the "Mult-Au-Matic Way"

BULLARD

Bridgeport, Connecticut

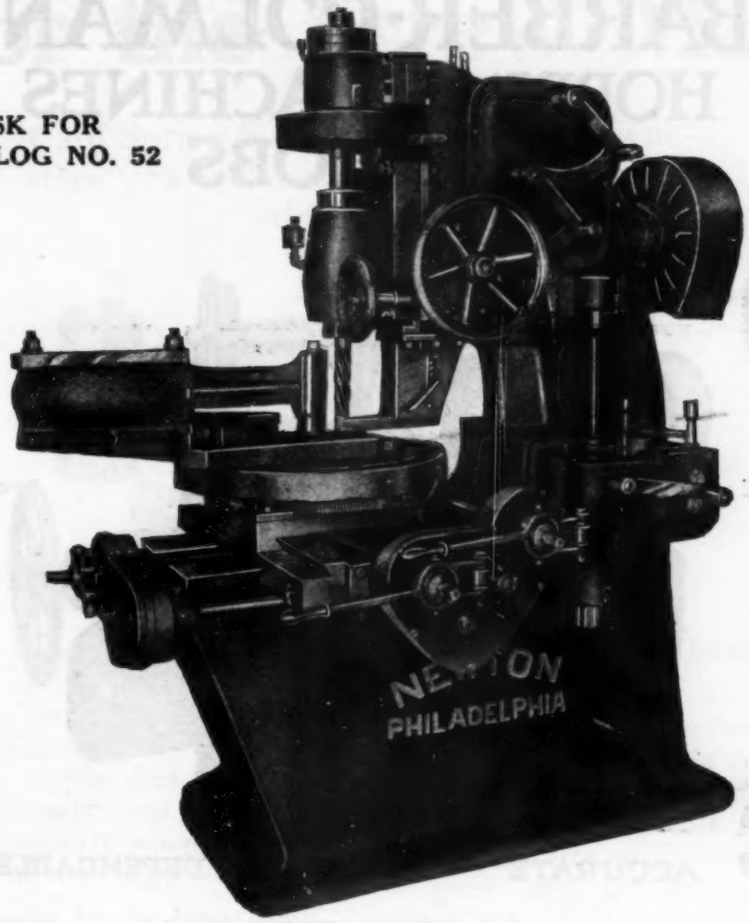
Builders of the Mult-Au-Matic, the Vertical Turret Lathe and the Maxi-Mill

NEWTON

(Registered Trade Mark)

VERTICAL MILLING MACHINES

ASK FOR CATALOG NO. 52



MILLING THE PISTON END OF ECCENTRIC STRAPS

NEWTON MILLING MACHINES

have the WEIGHT and SURPLUS POWER which eliminate vibration and insure steady, smooth cutting, together with the necessary feed, speed and control mechanism to give MAXIMUM PRODUCTION AT MINIMUM COST.

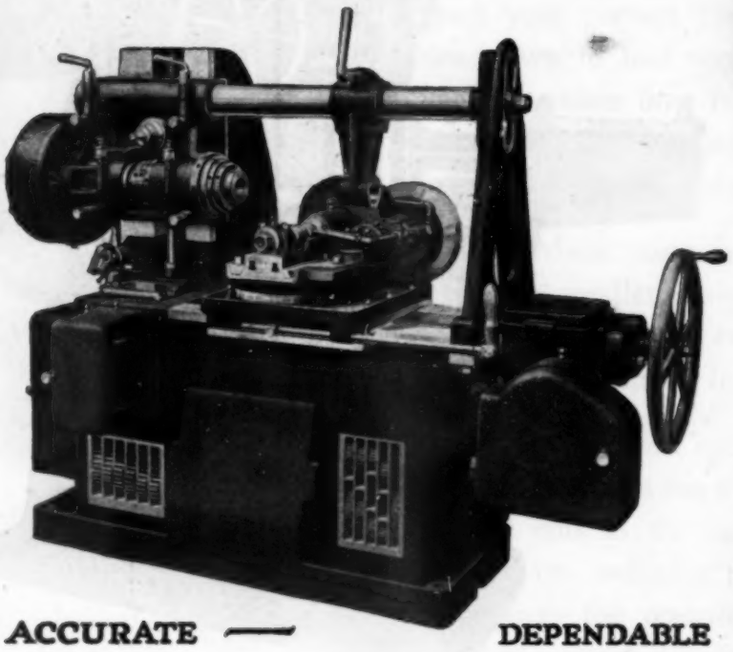
NEWTON MACHINE TOOL WORKS, Inc.

MILLING MACHINES
23rd and Vine Streets

Manufacturers of
SLOTTING MACHINES
ROTARY PLANING MACHINES
CRANK PLANING MACHINES

COLD METAL SAWING MACHINES
Philadelphia, U. S. A.

BARBER-COLMAN
HOBBING MACHINES AND HOBS



ACCURATE — DEPENDABLE

Showing a few of the various forms easily handled on Barber-Colman Hobbing Machines with B-C Hobs

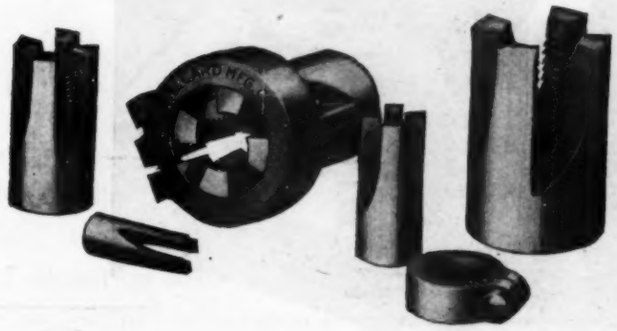
BARBER-COLMAN COMPANY
Home Office and Plant
ROCKFORD, ILL., U.S.A.

1026-53

CARD

Dies for the Screw Machine

Card Spring Screw Threading Dies will show you real results in screw machine threading.



Troubles usually experienced in the use of the ordinary spring dies are principally caused by the prongs closing in the hardening operation. If this takes place, the fingers of the dies are often not opened uniformly and therefore cannot be closed properly when adjusted to size by the use of the clamp collar.

By a special process in the heat treatment these troubles have been eliminated.

Card Spring Dies are relieved like a hand tap. They can be readily sharpened when dull by grinding the cutting faces and the muzzle end of the die. Users say they have longer life, produce a better quality of work, and are more durable than round dies.

Try these dies and you will order more—they repeat.

Catalog No. 30 upon request

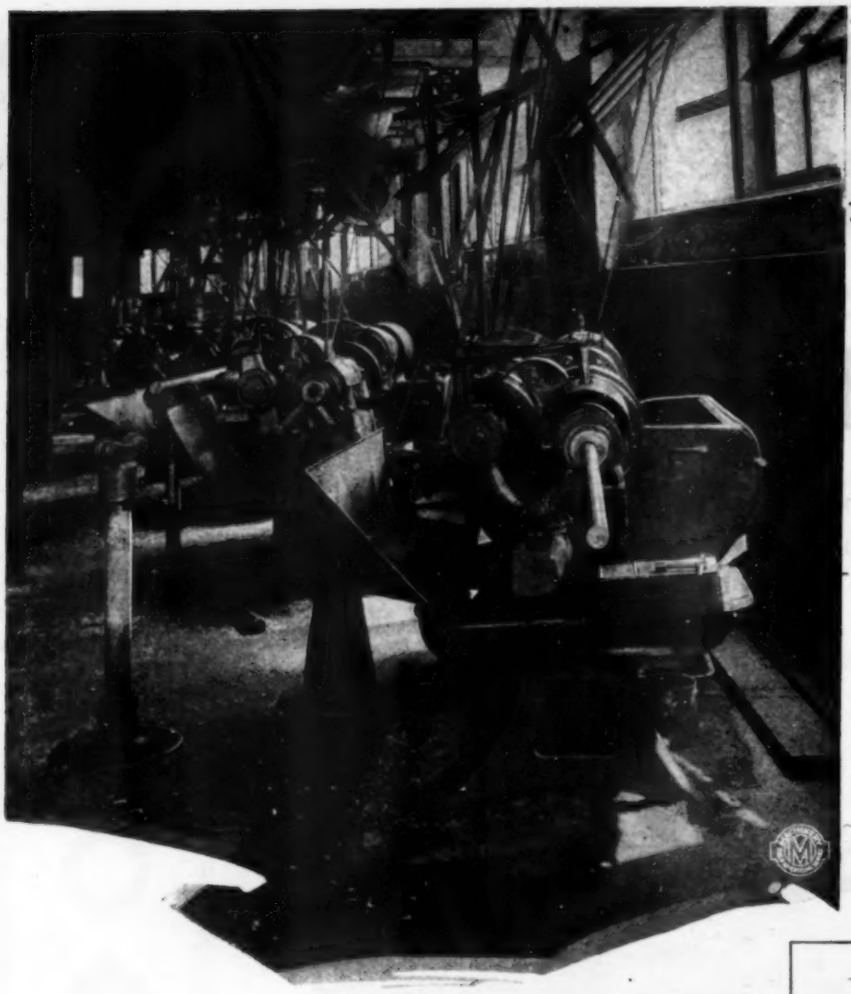
The CARD Quality

S.W. CARD MFG. CO.

DIVISION OF UNION TWIST DRILL CO.

MANSFIELD, MASSACHUSETTS, U.S.A.

FOREIGN AGENCIES: CHARLES CHURCHILL & CO., London, Birmingham, Manchester, Glasgow, and Newcastle-on-Tyne. V. LOWENER, Verterbrogade 9 B, Copenhagen, Denmark. AUX FORGES DE VULCAIN, General Office and Salesroom, 3 Rue St. Denis, Paris; Important Branches and Showrooms, Lyons, Bordeaux, Lille. V. LOWENER'S MASKINFORRETNING, Sverre Mohn, Christiania, Norway. C. CIVITA, Milano, Italy. R. S. STOKVIS & ZONEN, LTD., Rotterdam. J. LAMBERCIER & CO., Geneva, Zurich. V. LOWENER, Drottinggatten 90 Stockholm, Sweden. HIJO DE MIGUEL MATEU of Barcelona and Bilbao, Spain. R'AULIGNAC, Barcelona, Spain. ATELIERS DEMOOR, Brussels, Belgium. A. M. PAPASIDERIS & CO., Athens, Greece. ANDERSON, MEYER & CO., LTD., Shanghai, Changsha, Hankow, Harbin, Hongkong, Kalgan, Pekin, Tientsin, Vladivostok, China. M'ESTRE & BLATGE, Rio de Janeiro, Brazil, Buenos Aires, Argentine Republic.

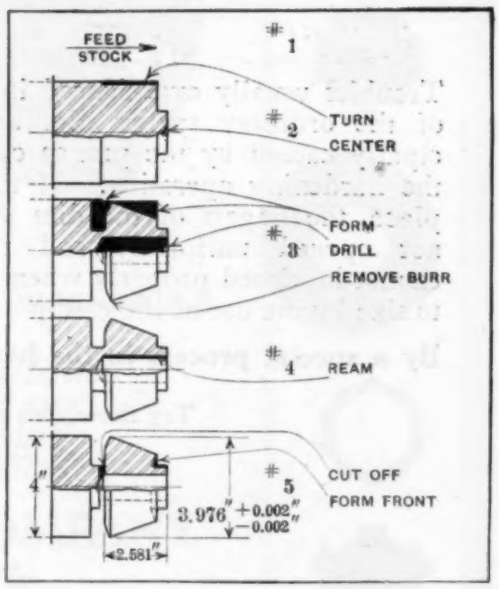


Foote Brothers Shortest Route

30 Bevel Gear Blanks Per Day Machined Complete from the Bar

These blanks are made from 4-in.—25-point carbon stock—formed, finished and cut off complete in five operations as indicated in the accompanying sketch. No second or "finishing" operation is required. They go straight from this machine to the gear tooth generator.

This operation is typical of the service Cleveland Automatics perform for Foote Brothers.



Allow us to quote outputs on your work.

THE CLEVELAND AUTOMATIC MACHINE CO.

Cleveland, O., U. S. A.

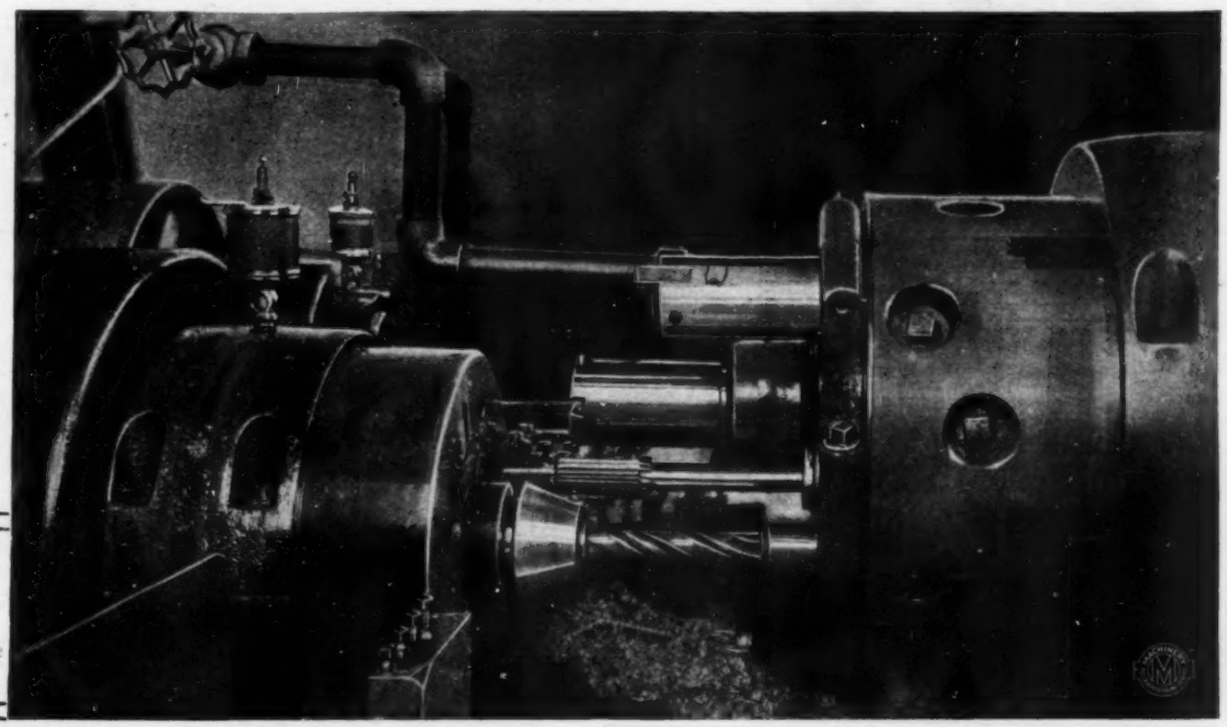
Find Eleven CLEVELAND Automatics the Between Stock Room and Gear Generators

The First One, Seven Years Ago "Sold" Ten More

From the very start (1910) Cleveland Automatics have made good in the busy, up-to-date plant of Foote Brothers Gear & Machine Co., Chicago. Gears, clutch hubs and other transmission parts have been their chief work.

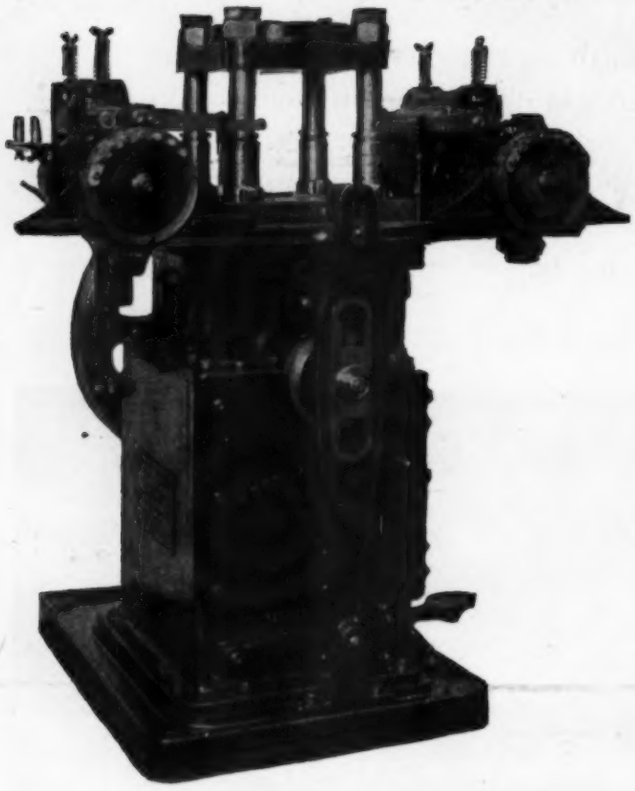
Not only does this line of speedy, sturdy machines have a wide range in size, but in their range of usefulness they have no equal.

They are easily set up and one man usually operates several machines. They are designed to produce all kinds of duplicate parts from bar stock and are readily adapted to handle castings, forgings and other second-operation work within their range. The quickness with which the magazine attachments can be applied gives every "CLEVELAND" a remarkable flexibility.



Features of the New Wright Dieing Machine that Revolutionizes Punch Press Work

The Dies are Unusually Accessible and Well Lighted



HERE is another big advantage over the old-style punch press. With the flywheel and crankshaft located below the dies there is no obstruction to light and the dies are readily visible and easily accessible for adjustment.

The feeding rolls seen on each end of the machine can be swung back making the setting of tools still easier.

There is an automatic arrangement of the operating treadles that makes the setting of tools a safe operation.

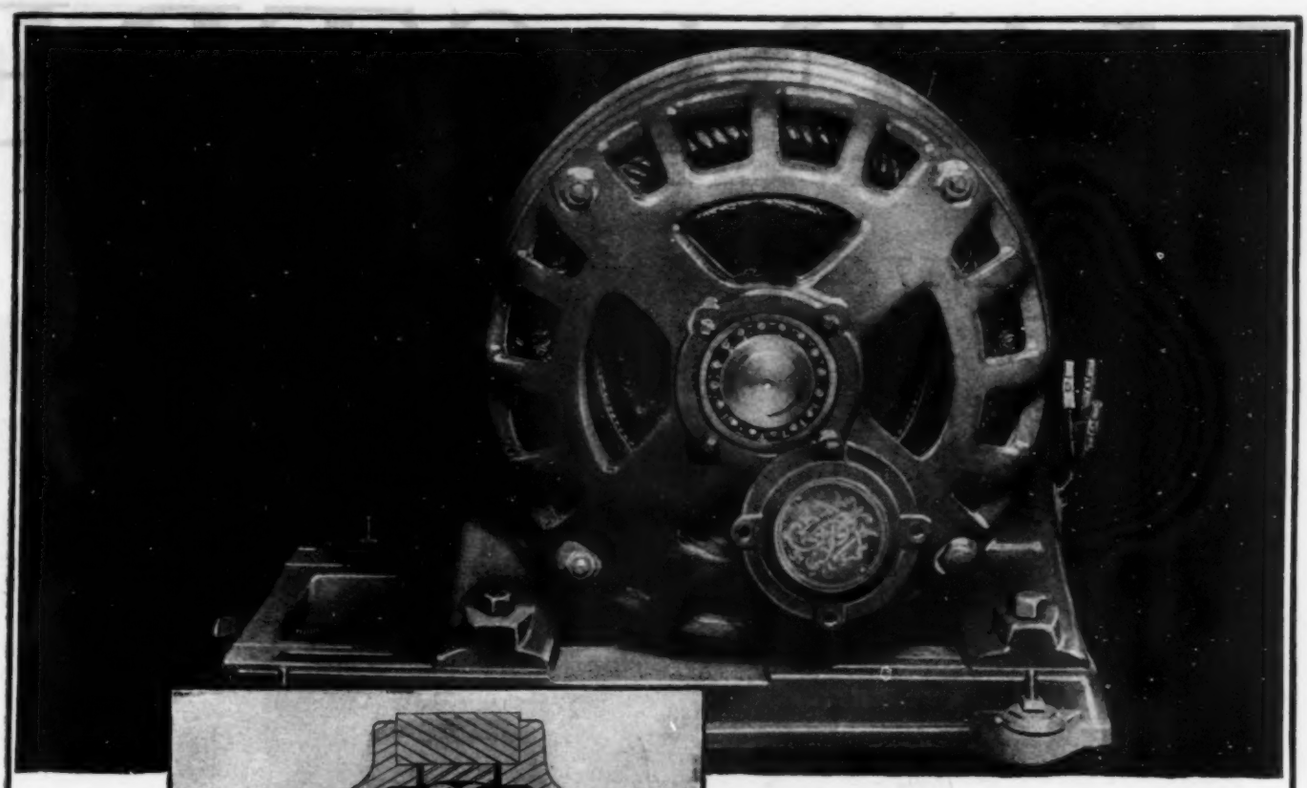
Let us tell you all of the many other big advantages of this new, correct-design dieing machine. If you do any punch press work it will mean, for you, greater production at less cost. Write today.

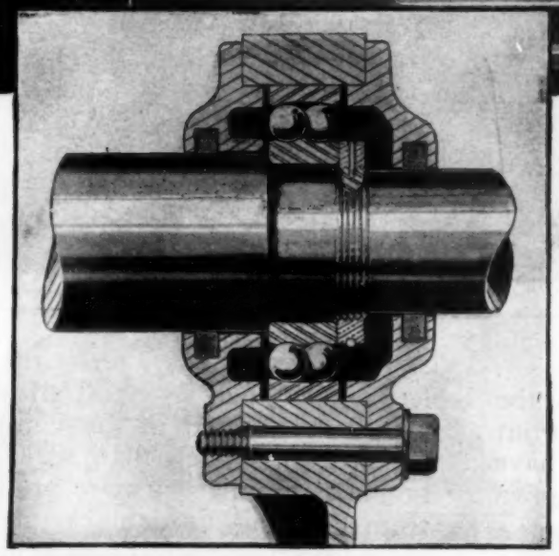
The Henry & Wright Manufacturing Co.

760 Windsor Street, Hartford, Conn., U. S. A.

Makers of

DRILLING MACHINES **DIEING MACHINES**





The twenty-horse-power induction motor with end cap removed showing the self-aligning ball bearing. Note that the ball bearings are contained within simply constructed bearing head brackets with liberal lubricant chambers, which are sealed on both sides by end caps. These end caps are fitted close to the motor shaft and are practically proof against leakage of lubricant, as well as the intrusion of moisture, dust, lint, grit and other foreign substances from without.

The use of ball bearings in electrical machines—

has been a continuous growth and is fast coming to be considered vital to the best mechanical practice in the design of electrical machinery. So marked is this fact that today the leading manufacturers of electrical machinery have a standard line of ball bearing motors.

Self-aligning ball bearings marked **SKF** are particularly adapted for motor uses and are so nearly frictionless that wear is practically eliminated. This insures perfect rotor alignment almost indefinitely with a constant high efficiency air gap for maximum motor life. And because they are wear-free, the bearings run cool and require a minimum of lubrication and attention.

The engineering experience of our organization is at your disposal. You are urged to submit your bearing problems to us for careful and impartial consideration.

The Skayef Ball Bearing Co.

Supervised at the Request of the Stockholders by

SKF Industries, Inc.

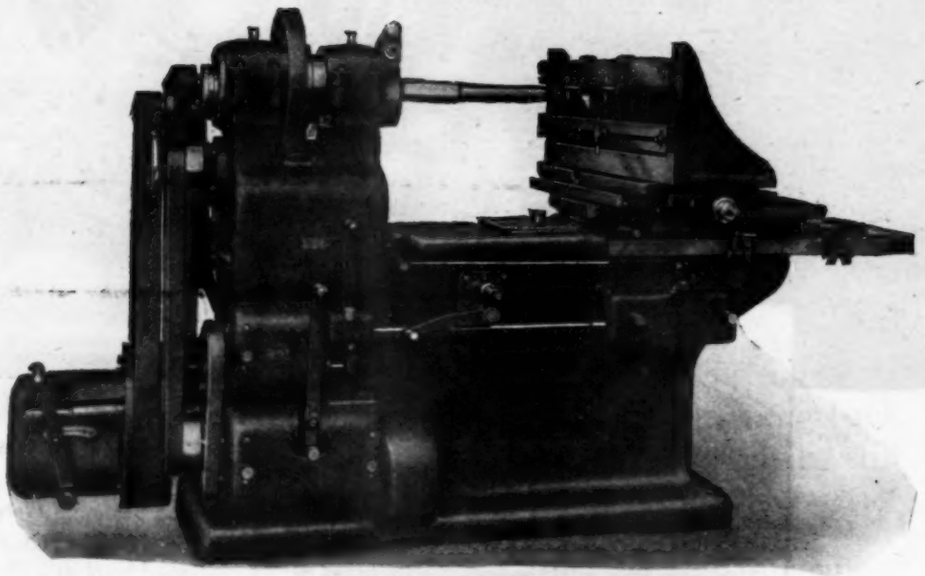
165 Broadway, New York City

623

MAIN STRE

Reveals the Facts

HEALD No. 65 Cylinder Grinder



Whether your shop is in the big city or the average town, there is one field of profit that is steadily growing and you have hourly evidence of it right on your own "Main Street."

We refer to cylinder regrinding, which is not confined to the garage or service station. In fact, it is more logical work for the small machine shop who is equipped with practically all of the required tools and needs but a Heald grinding machine to turn the hit-or-miss profits into a steady income. Established and with skilled workmen, nothing offers so simple and economical an opportunity as that of regrinding automobile cylinders.

Your town has its quota of the 10,000,000 cars now registered in this country and your shop, when equipped with a Heald, will keep busy on a share of these cars.

Remember that 75% of all the automobiles registered in the United States are in towns of less than 50,000 population and that there is more profit derived from grinding Ford blocks at a special price than higher class cars at big figures.

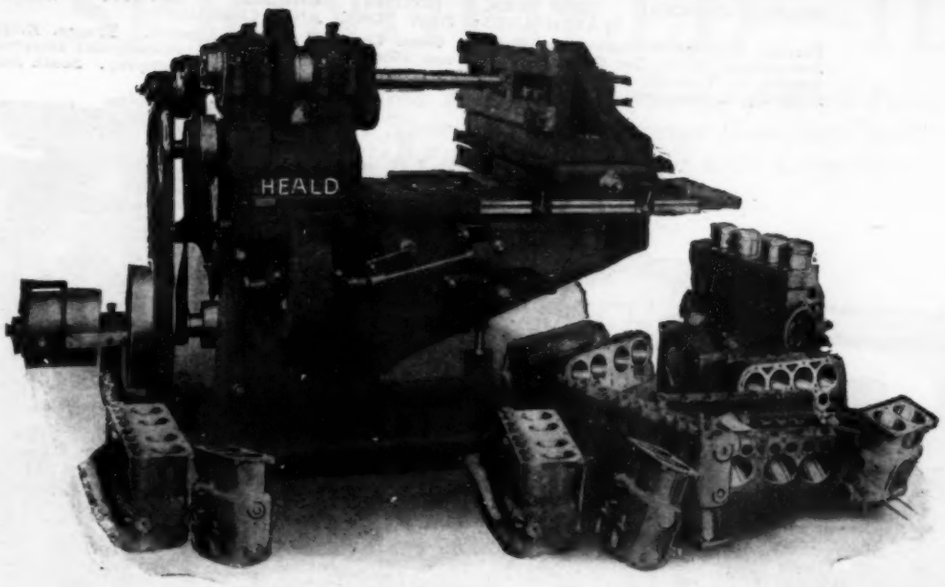
We can offer you two styles of machines—one the Style No. 55, a simplified machine with maximum range which is an ideal proposition for a small machine shop just starting in the business.

The Style No. 65 was primarily built for automobile manufacturers. It is unusually rigid and massive with extra speeds and feeds, and fitted with the Heald universal jig it is ideal for regrinding.

Take a look up "Main Street" and then ask us how you can secure the business you see rolling by.

ET

HEALD



HEALD No. 55 Cylinder Grinder

The Heald Machine Co.

35 New Bond Street, Worcester, Mass.

Branches: New York, 839 Singer Bldg.; Philadelphia, 1302 Stephen Girard Bldg.; Chicago, 26 South Jefferson St.; Detroit, 400 Marquette Bldg.; Cincinnati, 311 Provident Bank Bldg.; Cleveland, 721 Engineers Bldg.; Buffalo, 331 Jewett Ave. **Agents:** Eccles & Smith Co., San Francisco, Los Angeles, Portland and Seattle; Salt Lake Hardware Co., Salt Lake City; Hendrie & Bolthoff Mfg. & Supply Co., Denver; F. E. Satterlee Co., Minneapolis; The Oliver H. Van Horn Co., New Orleans; The Russell Hardware Co., McAlester, Okla.; The Young and Vann Supply Co., Birmingham; G. Norman Baughman Co., Tampa; The Walraven Co., Atlanta; The Cameron and Barkley Co., Charleston, S. C.; Greensboro Supply Co., Greensboro, N. C.; Benjamin T. Crump Co., Richmond; Geo. F. Foss Machinery Co., Montreal, Can.; H. W. Petrie, Ltd., Toronto, Ont., Can.

Speaking of Ten Operations and the "ACME Way"

All ten of the operations on this 1¼ in. brass piece were performed on the Acme in the time it would take you to FORM the piece by any method that you could use.

This is a simple example of what it means to costs when enough tools can be used to do the maximum of operations on your screw machines. This means simply that on Acme Automatics you substitute the small expense of extra tools for the big expense of machinery and labor for rehandling the work.

We suggest that you pick up some of your screw machine work on which operations are now being handled on secondary machines, tell us how accurate you want them, ask us if they can be done on Acme Automatics, and what guaranteed production figures we can quote.

Find out Acme costs. No obligation.

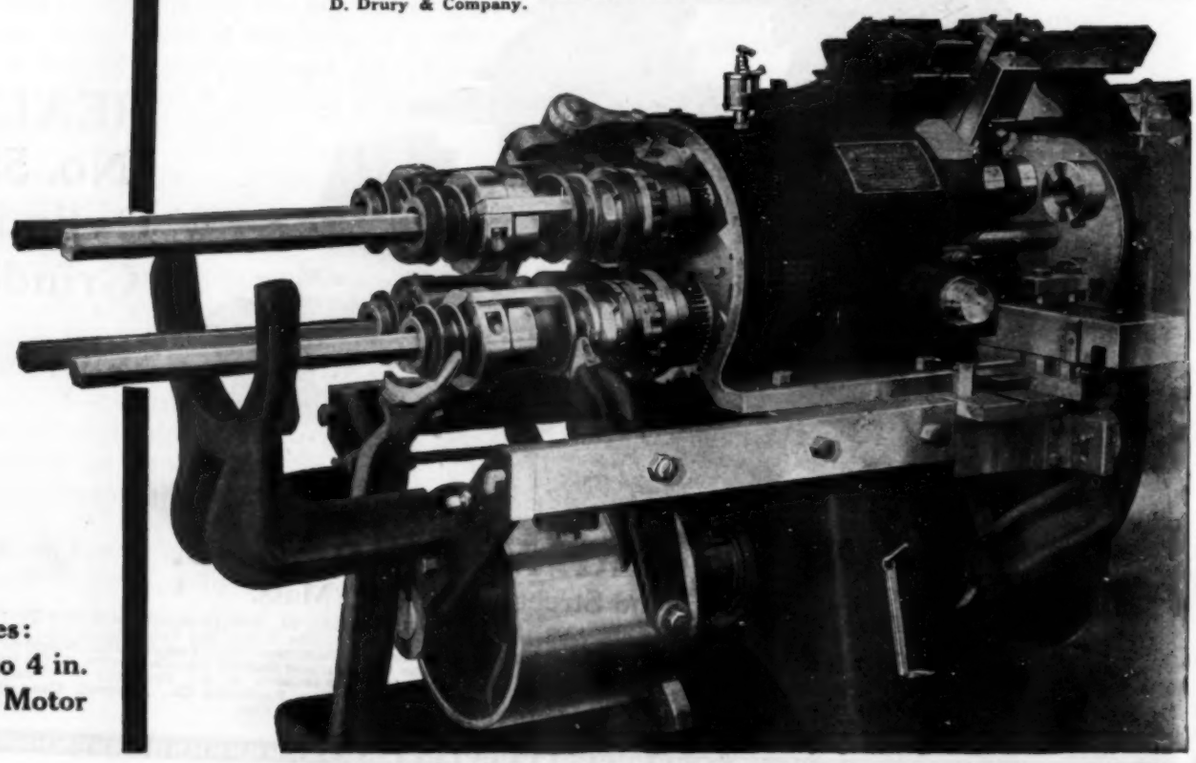
THE NATIONAL ACME COMPANY

CLEVELAND, OHIO

New England Plant, Windsor, Vt. Canadian Screw Plant, Montreal, P. Q.

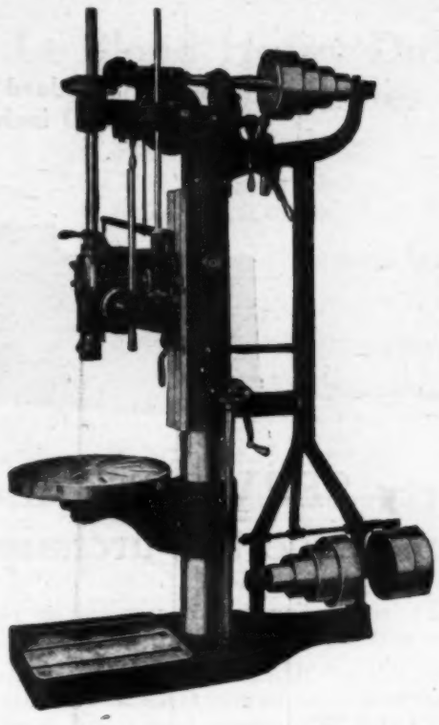
BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO
WAREHOUSES: NEW YORK AND CHICAGO

Foreign Representatives: Great Britain, Chas. Churchill & Co., Limited. France, Belgium, Switzerland, Spain; for Gridleys, Potter and Johnston; for Acmes, Etablissements Horstmann. Sweden, E. Trobeck, Australia, Benson Brothers. Japan, Yamatake & Company. South Africa, D. Drury & Company.



Sizes:
¾ in. to 4 in.
Belt or Motor

Complete Line of 8 inch to 50 inch Swing (with or without Tapping Attachment)



Upright DRILLS
Horizontal DRILLS
Gang DRILLS

Convenience of Operation
Accuracy—Strength

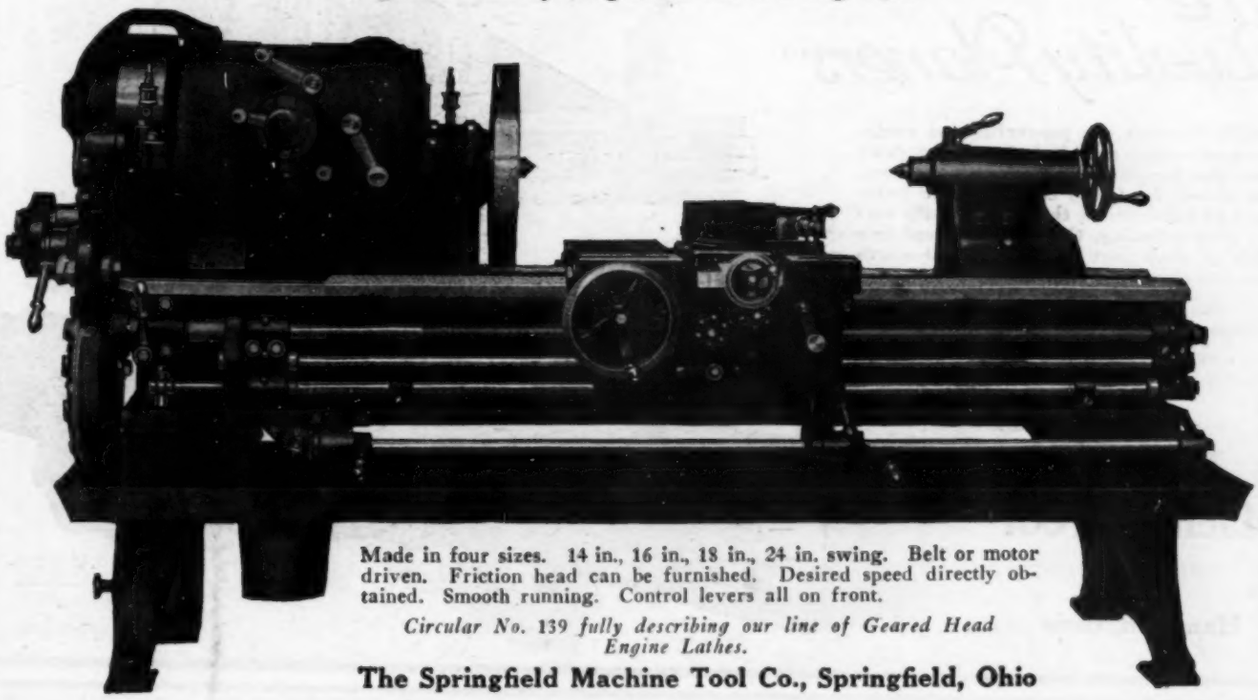
TRADE W.F. AND J.B. MARK

Made by

W. F. & JOHN BARNES CO.
1995 Ruby Street, Rockford, Ill., U. S. A.

SPRINGFIELD—IDEAL

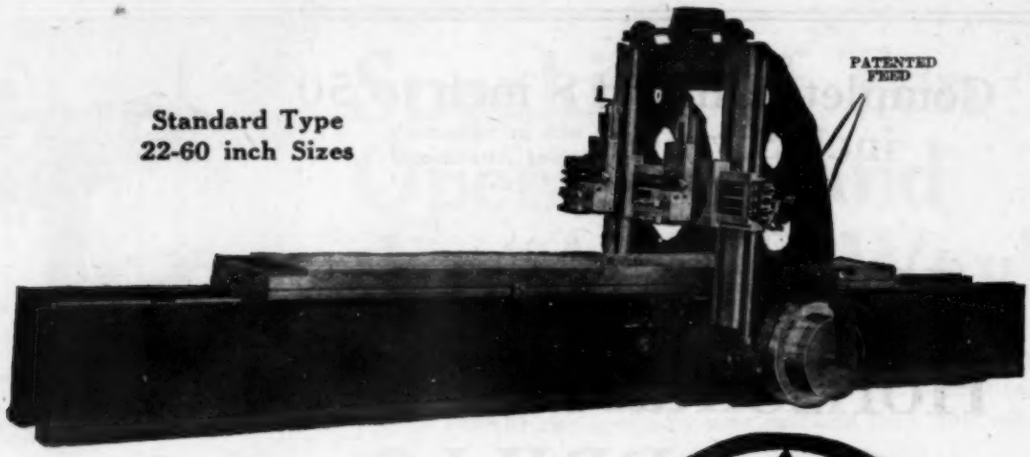
A Geared Head Engine Lathe of High Power, Correct Speeds, Rapid Change Gearing Facilities, High Efficiency Together with Long Life



Made in four sizes. 14 in., 16 in., 18 in., 24 in. swing. Belt or motor driven. Friction head can be furnished. Desired speed directly obtained. Smooth running. Control levers all on front.

Circular No. 139 fully describing our line of Geared Head Engine Lathes.

The Springfield Machine Tool Co., Springfield, Ohio



Standard Type
22-60 inch Sizes

Liberty SERVICE is Also Wrapped Up in a Liberty Purchase—

LIBERTY engineering service, supplied by planer experts, is as distinctive as the LIBERTY PLANER itself.

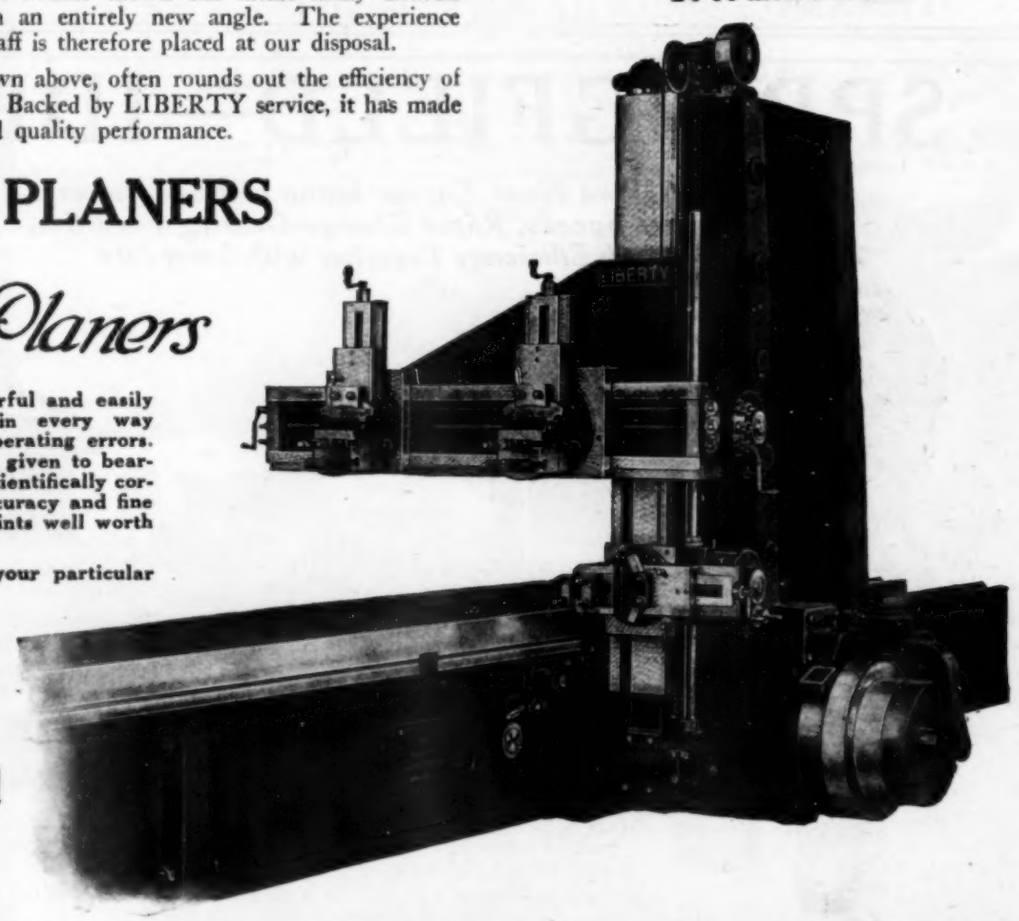
When you buy a "QUALITY PLANER" not all of your purchase comes on the skids or in crates, loaded from our shipping platform. Many "LIBERTY" owners have found short cuts to production through the combination of *"LIBERTY Service,* and the LIBERTY PLANER.

Because of its remarkable capacity, brute strength and time-saving refinements, the Openside Planer shown can tackle many difficult machining problems from an entirely new angle. The experience and advice of our own staff is therefore placed at our disposal.

The Standard Type, shown above, often rounds out the efficiency of your planer department. Backed by LIBERTY service, it has made a record for economy and quality performance.

LIBERTY MACHINE TOOLS

Open Side Planers
24-60 inch Sizes



LIBERTY PLANERS

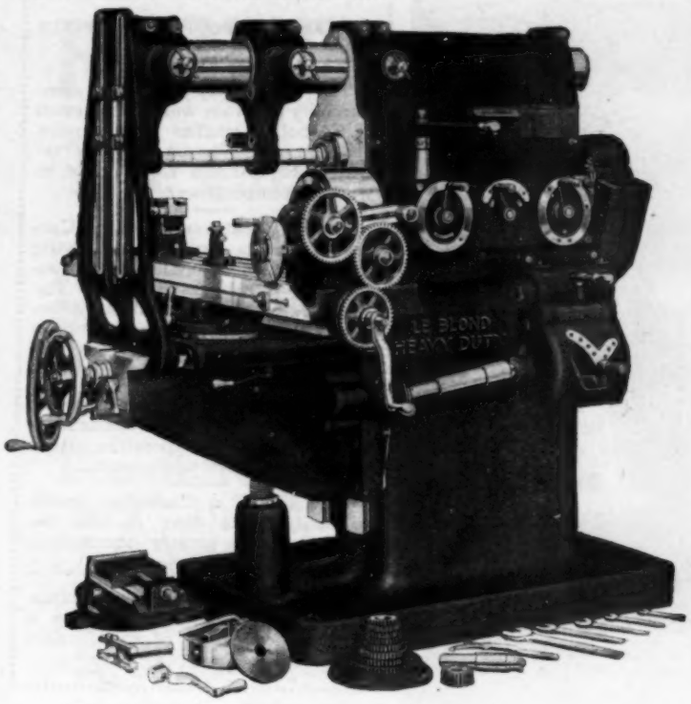
are Quality Planers

Quality Planers are powerful and easily operated—are guarded in every way from the possibility of operating errors. The patent feed, the care given to bearings and lubrication, the scientifically correct proportioning, the accuracy and fine finish of each part are points well worth your attention.

May we advise you on your particular problems?

Liberty Machine Tool Co.

Hamilton, Ohio



Le Blond Heavy Duty Milling Machines

Plain or Universal
Cone or Gear Drive
Sizes No. 0 to No. 5

Have right-hand centralized control system.

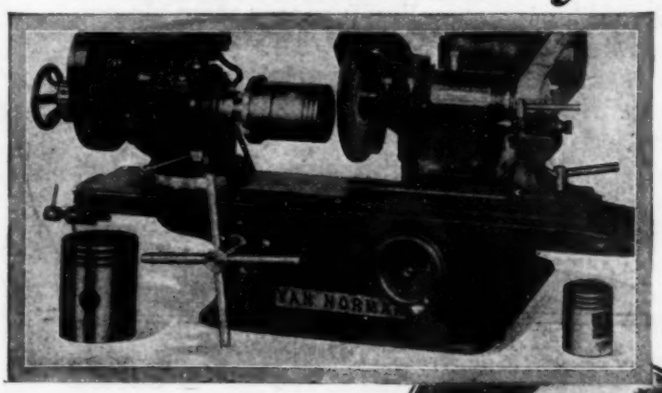
Patent self-aligning arbor support, with unusually large over arm.

Centralized oiling.
Hardened spindle bearings.
One-piece column.
Unit feed box.
Two-lever control.

Broader bearing surfaces and larger dimensions contributing to increased production and reduced depreciation.

The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio

Its Versatility Keeps It Busy



The Van Norman "Re-li-o"

Grinds and turns pistons, valves, wrist pins, commutators, etc.
Regrooves pistons.
Grinds externally and internally.

The Van Norman "Re-li-o" will prove to be the busiest machine in your garage, service station or repair shop.

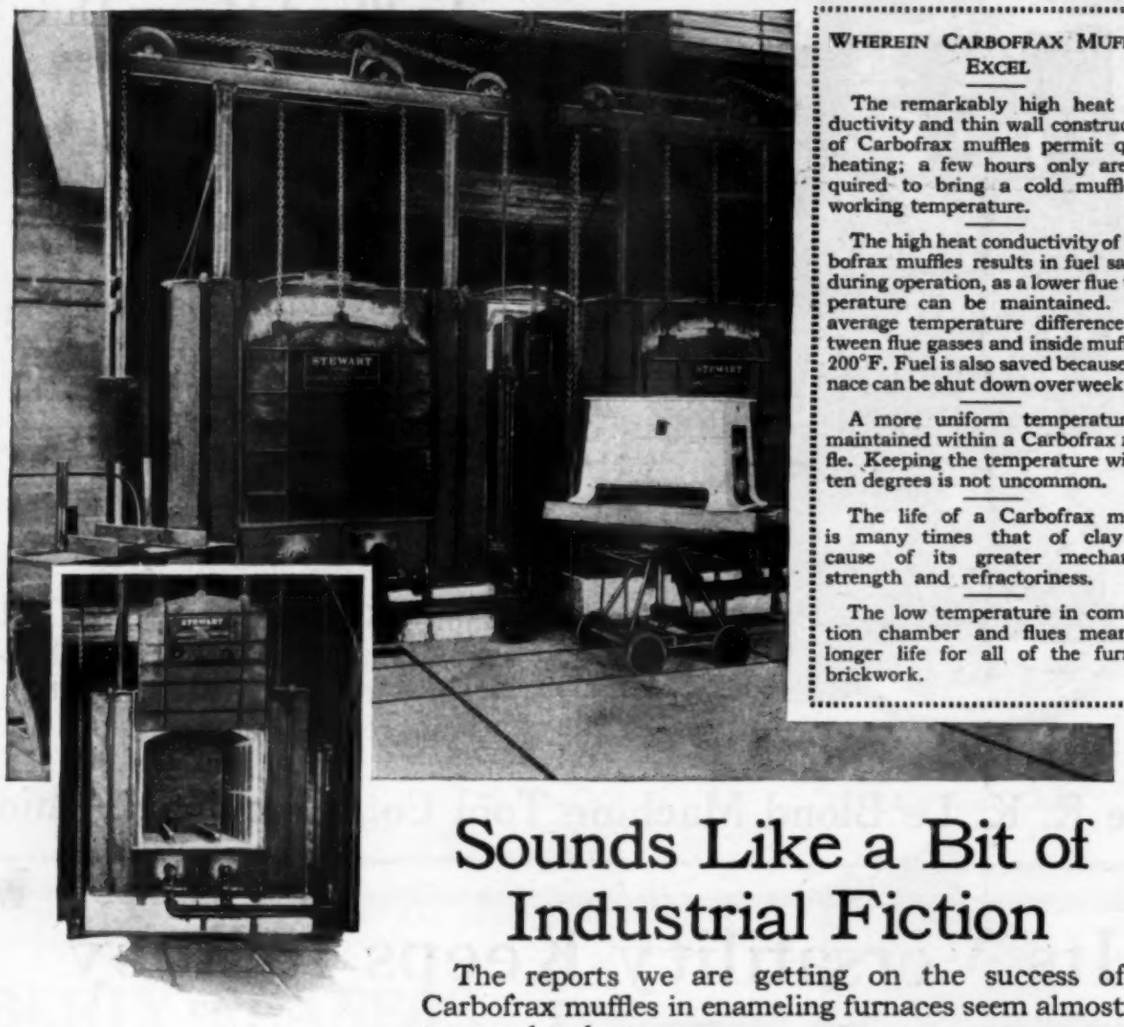
It combines the machining virtues of a lathe and grinding unit—both external and internal.

It will quickly prove its ability to speedily and accurately handle a major portion of all the small turning and grinding work that comes your way.

Set-ups and adjustments are simple and easy; both internal and external grinding operations can often be performed with one chucking of the work.

Let us tell you how you can enhance quality and lower cost by installing the "Re-li-o."

Van Norman Machine Tool Company
Office and Factory:
160 Wilbraham Street
Springfield, Mass., U. S. A.



WHEREIN CARBOFRAX MUFFLES EXCEL

The remarkably high heat conductivity and thin wall construction of Carbofrax muffles permit quick heating; a few hours only are required to bring a cold muffle to working temperature.

The high heat conductivity of Carbofrax muffles results in fuel saving during operation, as a lower flue temperature can be maintained. The average temperature difference between flue gasses and inside muffle is 200°F. Fuel is also saved because furnace can be shut down over week end.

A more uniform temperature is maintained within a Carbofrax muffle. Keeping the temperature within ten degrees is not uncommon.

The life of a Carbofrax muffle is many times that of clay because of its greater mechanical strength and refractoriness.

The low temperature in combustion chamber and flues means a longer life for all of the furnace brickwork.

Sounds Like a Bit of Industrial Fiction

The reports we are getting on the success of Carbofrax muffles in enameling furnaces seem almost too good to be true.

One such report comes from The Creamery Package Company of Wisconsin. There they installed a Carbofrax muffle in a Stewart furnace used for enameling 550 pound bases for ice cream freezers.

With a fire clay muffle, it took them twenty-eight hours to bring the furnace to enameling heat. With the Carbofrax muffle it now takes them just five hours to reach the same temperature—twenty-three hours faster on heat pick up. The reason for this is, of course, the remarkable heat conductivity of Carbofrax. It is nine times that of fire clay.

This Carbofrax muffle not only saves time and fuel but will outlive any fire clay muffle by months.

In this particular instance production has been increased 100%. It should be remembered, however, that they are firing unusually large castings.

Many such stories of the proved efficiency of, not only Carbofrax muffles, but the other Carborundum Refractories, are constantly coming to us.

Glad to let you have full details.

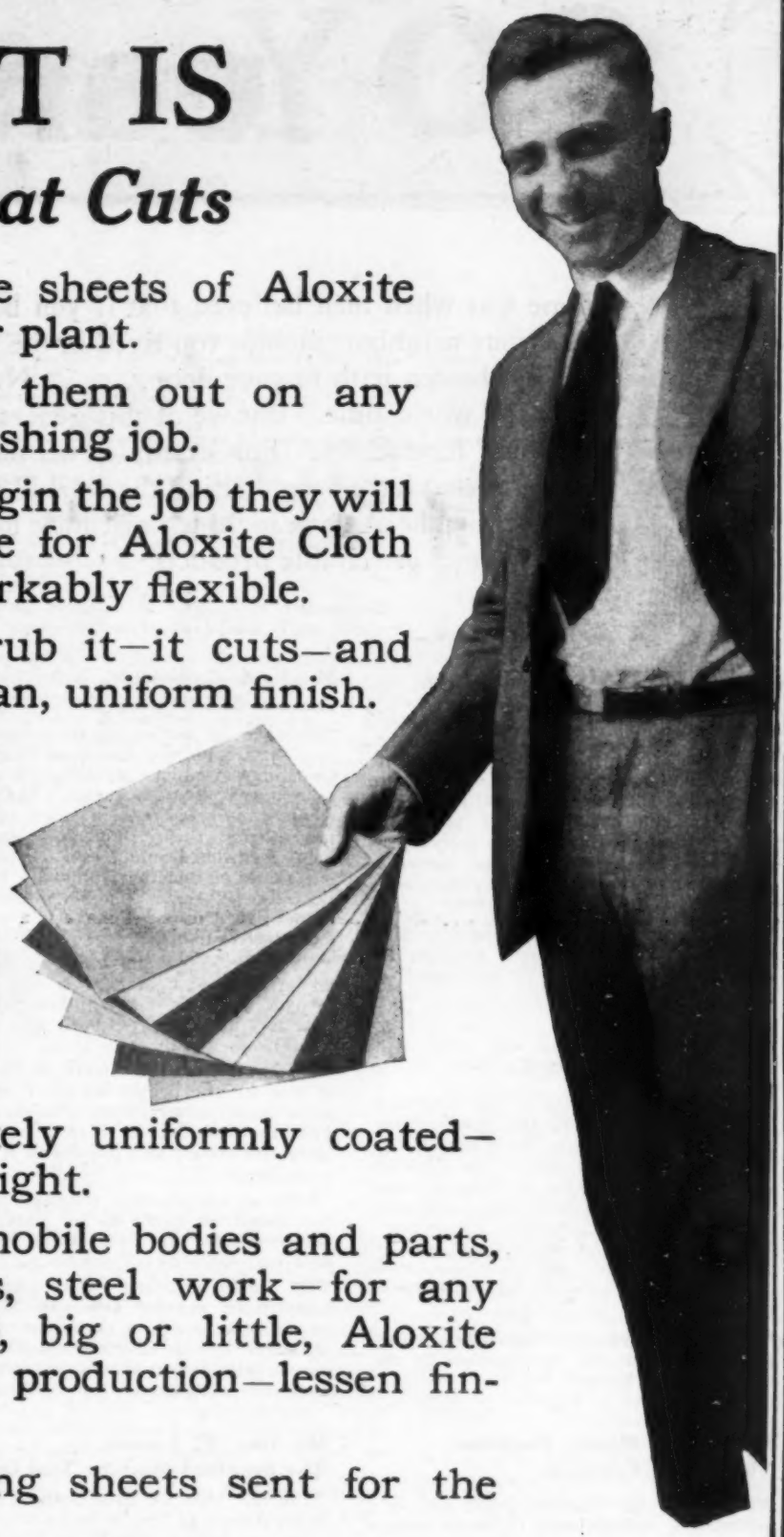
Carborundum Refractories

Brick Tile Muffles Retorts Cements

The Carborundum Company, Perth Amboy, N. J.

HERE IT IS

The Cloth that Cuts



GET these sample sheets of Aloxite Cloth into your plant.

Have the men try them out on any kind of a metal finishing job.

The minute they begin the job they will "feel" the difference for Aloxite Cloth Cuts and it is remarkably flexible.

It doesn't merely rub it—it cuts—and always leaves a clean, uniform finish.

Aloxite Cloth not only out-cuts but it out-lasts any other abrasive cloth.

It does these things because it is coated with the selected Aloxite grain—because it is absolutely uniformly coated—because it is made right.

For finishing automobile bodies and parts, machine tool parts, steel work—for any metal finishing job, big or little, Aloxite Cloth will increase production—lessen finishing costs.

The sample working sheets sent for the asking.

Made in all standard grits in sheets, rolls and belts

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

New York, Boston, Philadelphia, Chicago, Cleveland, Cincinnati, Milwaukee, Pittsburgh, Grand Rapids, Detroit

20 Years Contin

Time was when men believed that if you built a better mouse trap than your neighbor, though you lived in the woods, the world would make a beaten path to your door..... No doubt it would, if you gave the world time. But we of this generation are more impatient than our forefathers. For example, we publish here letters from concerns that have been "telling the world" for the past twenty years or more in the American Machinist how to follow the blazed trail to the homes of reliable products.

Mr. R. W. Van Hyning, *Manager*,
Bignall & Keeler Mfg. Co.

"Twenty odd years ago this company began advertising in the American Machinist. Space has been used every week during this time. Several managers have been on the job since the first contract was signed, and all the succeeding managers have agreed that the contract should be renewed from year to year, and the space has even been increased.

"All this proves that we consider the American Machinist a good medium in which to advertise our pipe machines."

Mr. Hugo Bilgram,
The Bilgram Machine Co.

"I have been reading the American Machinist since 1879, and, particularly during the earlier time, have found it a great help. Indeed, one of the Chordal Letters, published for a number of years by you in regular succession, encouraged me to develop an invention I had previously conceived and which I was told by an expert, could not compete with machines that were used for the purpose before.

"I may therefore, say, that in a measure, I owe my success in business to the American Machinist."

Mr. Eugene Adams, *President*,
The Adams Company.

"The American Machinist has had our advertising continuously for over twenty years. During all that time our relations with them have been perfectly satisfactory in every respect. They have assisted us greatly in forming our advertisements."

Mr. F. A. Collins, Jr.,
Auburn Ball Bearing Co.

"Members of our organization have been brought up on the American Machinist. Our Superintendent contributed articles to it twenty-five years ago. The writer, when studying seventeen years ago, well remembers the American Machinist being mentioned among selected technical magazines as one that should be read by the factory executive. My predecessors used to read it and I make it a point to look over every issue.

"We think your magazine is gotten up in an original and attractive way. The articles are timely and interesting. We clip and file subjects, both articles and advertisements, of value to us.

"We know that the American Machinist is read by the people we want to reach, from actual observation. The writer has been in the offices of many factory and shop executives, and has found it always in evidence.

"From closely checked returns years ago, we found it paid us to increase our advertisement from a small card to sufficient space to tell our story.

"We would as much think of giving up advertising in the American Machinist as refuse an order at this time. Returns indicated by our advertisement key have consistently shown that we must continuously advertise in it."

Mr. Geo. F. Stewart,
The Bradford Machine Tool Co.

"The fact that we have been advertising in the American Machinist for over twenty years, we believe, speaks for itself.

"We have watched this publication grow from a very small book to its present dimensions and have noted that you have held all of the old-time advertisers like ourselves, so you must have given results, for after all results are what we all look for."

Mr. Z. Chafee,
Builders Iron Foundry.

"To one who can look back at the earlier numbers, the growth of the paper is especially significant and impressive.

"The Founders did their work well and their successors have built satisfactorily.

"The number of the advertising pages and the size of the circulation list are appropriate comments on the usefulness and the value of the paper."

Mr. W. B. McSkimmon, *Secretary*,
S. W. Card Manufacturing Co.

"The S. W. Card Mfg. Company is one of the oldest advertisers in your paper. Our company here has always felt that the American Machinist is to the metal-working trades what the New York Sun years ago was to the thinking readers all over the country.

"Outside of the high personal regard which I have had for many years for the management of the American Machinist, there is the fact that we regard the American Machinist as the leader in its field and a staunch, loyal, helpful friend to all of us who are engaged in the manufacture of machinery or tools.

"We all highly appreciate the service you have rendered to mechanics in general during the entire life of your paper. One fact that stands out with the writer is that the American Machinist has always stood for something definite and it has been particularly fortunate in the choice of the people who have represented it.

"I know that when we think of advertising

AMERICAN MACHINIST—

uous Advertising

in our line in any of the various lines in which we are connected, I think first of the American Machinist, and I believe that is about the highest testimonial that one could give you."

Mr. Francis D. Bowman,
Advertising Manager,
The Carborundum Company.

"First of all, please let us congratulate the American Machinist on completing forty-four years of helpful endeavor. For over twenty-five of these forty-four years The Carborundum Company has been advertising in your publication and in all that time there has never been anything but a condition of ideal relationship between your concern and ours.

"Aside from the pleasure of dealing with men always holding the highest ideals of business, as typified by those men of the staff of the American Machinist, we have always considered the American Machinist as a most profitable business asset.

"From the very early days when we first offered you a contract, and the then new product, Carborundum, was closely investigated by your people before accepting our business, until now, we have gradually increased our space, believing as we do in the splendid influence which your publication exerts in its field.

"We hope to long continue our business relations with the American Machinist and at the same time, it is my wish that the personal friendships that have been made during such relationship be further strengthened.

"We believe in American Machinist absolutely. The best evidence of that is found in the fact that we are now using fifty-two pages a year."

Mr. Jack C. Carlton, *President,*
The Carlton Machine Tool Company.

The fact that we, with our predecessors, have been advertising in the American Machinist for the past twenty years expresses the high opinion we have for your paper which we believe is at least the equal, if not the leading machine tool trade paper published in the World today.

"The writer's previous position in which he had to travel a great deal both in this country and abroad, enabled him to come in contact with almost all of the large users of machine tools and every one of them use the American Machinist as a guide to keep them up-to-date on this subject, as well as other interesting subjects published in your paper. This is particularly so in Europe as the writer was very much surprised at the popularity of the American Machinist, not only with the Buyers of machine tools, but also the men in the shops. In this way they were able to keep up with the advance designs of the American machine tool manufacturers."

Mr. August H. Tuechter, *President,*
The Cincinnati Bickford Tool Co.

"It gives me very much pleasure indeed to note this particular anniversary of the American Machinist and to make a statement in connection relative to my experience as an advertiser. In order to do this I must go back quite a little time, and will explain that The Cincinnati Bickford Tool Co. is the successor of the former Bickford Drill & Tool Co., and Cincinnati Machine Tool Co.

"When these two companies were brought together under the name of The Cincinnati Bickford Tool Co., advertising in the American Machinist was steadily continued, two pages being finally used, all of which will clearly indicate that the value of the American Machinist as an advertising medium was appreciated and regarded more and more as time went on.

"I wish the American Machinist for the future the same success that it has enjoyed in the past, and I wish to thank those associated with it for their courtesy and attention which they always extend to their patrons."

Mr. B. B. Quillen, *President,*
The Cincinnati Planer Company.

"When I went to work in a machine tool plant back in 1892, the American Machinist was brought to my attention by the 'boss' as the leading mechanical paper in the World, and he impressed upon me the importance of reading it regularly and thoroughly. So from the start, I learned to have a very high regard for the American Machinist, and when I entered into business for myself in 1898, as The Cincinnati Planer Company, I immediately put an ad in the American Machinist, and we have advertised continuously since that time.

"I not only became well acquainted with the American Machinist itself, but also with the President, Manager and Editors, and the better I knew the paper and its personnel, the more I appreciated its value in the Mechanical World, and by reason of its splendid service, it is only natural that it should be a valuable advertising medium in this field.

"Your policy is absolutely fearless and independent. No fake 'ads' or write-ups tolerated; rates, service and consideration the same to everybody.

"The American Machinist is as much a part of our business as the labor and material that enters into the product."

Mr. P. G. March, Jr.,
Secretary and Treasurer,
The Cincinnati Shaper Company.

"You can rest assured that we hold a high opinion of the American Machinist and it is our intention to resume our advertising to a larger extent as soon as we feel that conditions permit."

Mr. J. P. Brophy,
Vice President and General Manager,
The Cleveland Automatic Machine Co.

"It has just come to our notice that in November the American Machinist will be forty-four years old and such being the case our minds revert back to our being a constant advertiser in your paper for over twenty years, and perhaps you would like to hear that the results we have obtained from this advertising have been exceptionally satisfactory.

"We want to compliment you on one fact and that is that you have worked with us in a very agreeable manner in every way possible to make our advertising interesting, and we can say this much, that our men in traveling around nearly all over the United States discover that the American Machinist is in the office of most managers, regardless of their being in lines of business where you would think they would not make use of such a publication as the American Machinist, but it seems that wherever machinery of any kind is used that they are regular subscribers to the American Machinist, for the information it contains in various ways that is helpful, both from a standpoint of information secured by the reading of that which is sent in by your correspondents and also from the standpoint of being able to ascertain what is on the market in machine tools and various small tools of all descriptions.

"We might add that it is very common for us to receive letters from prospective customers in this country and abroad where

20 Years Contin

they explain to us that they have read our ad in the American Machinist and they are after more information in reference to our ability to produce certain parts that they had in mind by sending us along their sketches or blueprints. This has been quite a common experience with us for a great number of years past, which proves conclusively that mechanical men are interested in what the American Machinist contains.

"It is a great pleasure to us to be able to write you in this way, and considering the number of years we have been doing business with you, our relations have been exceptionally satisfactory; so we thought it was due you to send along a letter of this kind to show how satisfied we have been with the results of our advertising in the American Machinist for the last twenty years."

Mr. F. A. Errington,
Errington Mechanical Laboratory.

"An advertisement in the American Machinist was my early ideal of 'Going into business for myself'; and I still consider it the criterion by which the public determines whether a concern is 'keeping up with the procession.'

"Moreover, whenever I am 'stuck' for any technical or other knotty point that may come up, I early acquired the habit of going to 'Old Man Hill' of the American Machinist, and I have seen him (and his organization after him) 'get away with anything from handing out just the proper 'shop kink,' to raising—in one instance I remember—$1,250,000 cash capital for one concern who went to Mr. Hill in distress.

"In these days when everyone of us is compelled to carry the government on our pay roll as a 'Senior Partner' with a corresponding excessive and uncertain overhead, even the 'old timers' find the foundations of their experience swept away by new conditions, and we all must rely upon our trade journals as the best rallying point from which to gather data as to present conditions from which to launch our individual campaigns to meet future conditions, that are ever pressing upon us for solution."

Mr. Herbert L. Flather,
Treasurer and Superintendent,
Flather & Company, Inc.

"Our experience in advertising is that it is unwise to advertise machine tools except in such papers as have a national or international reputation, the American Machinist being a leading example of this kind.

"For about twenty years we have been a constant advertiser in your paper, and an intermittent one before that, and during all this period we are very glad to be able to say that the treatment which you have accorded us has been one of great satisfaction to us and we have had no occasion to regret placing the major part of our advertising with you.

"Although at the present time the business outlook is very discouraging, we have thought it wise to carry our full amount of advertising, and this fact in itself is the best indication we can point to, as to what we think of the value of your paper as an advertising medium."

Mr. Howard E. Adt, *President,*
The Geometric Tool Company.

"It is perhaps needless for me to say anything about my very high regard for the American Machinist, either as an advertising medium or of its high-grade and progressive standards as a technical journal, for I have read the American Machinist, almost from its first issue, and have used its advertising columns increasingly during the past thirty years, and it is needless therefore for me to express to you my very high regard for the American Machinist, but it is a pleasure nevertheless, to be able to congratulate you, which I do most heartily, upon the very great success to which the American Machinist has been brought upon the occasion of its forty-fourth anniversary, and to predict for it, under its most able and efficient management, many years of increasing prosperity and ever-increasing popularity."

Mr. Geo. Gorton,
George Gorton Machine Company.

"Personally I have several very good friends publishing other mechanical papers and have from time to time run advertising with such during the past twenty-five years.

"However as you may have noted, we have as often discontinued such ads, but have never felt we could afford to quit American Machinist. The reason is, we got business from each dollar spent with you, that we have always been unable to get from any other paper—and several of them are good journals of course."

"No paper has ever seemed to fit our requirements as does American Machinist.',

Mr. J. J. Lannon, *Treasurer,*
Grant Gear Works.

"When we say that we have been continuous advertisers in it for upwards of twenty years, we probably say all that is necessary; but can add that we have always been very well satisfied with the results obtained from our space in the American Machinist.

Mr. C. A. Hoefer,
Hoefer Manufacturing Co., Inc.

"We do not recall just when our first ad appeared in the American Machinist, but we know that it is over twenty years ago, and we do not think that we have been out of the paper since that time.

"The very fact that we started in with a sixteenth page and have increased until we are using full pages, shows on the face of it, what we think of the advertising value of the American Machinist.

"We know that when we have added some special detail, that we get many letters which mention the American Machinist as the source of their information.

"We feel that the means for reaching people we want to reach is the American Machinist, and it is for that reason we so consistently take space in your paper."

Mr. R. K. LeBlond,
The R. K. LeBlond Machine Tool Co.

"We have been advertising in your publication since 1895, a matter of some twenty-six years; and we are more than satisfied. It is a hard matter to trace the results of advertising, but, after careful analysis and experience, from tracing and keying advertisements, we have come to the conclusion that the American Machinist is one of the very best advertising mediums for the machine tool manufacturer."

Mr. J. Wallace Carrel,
Vice President and General Manager,
The Lodge & Shipley Machine Tool Company.

"We congratulate the American Machinist on reaching the ripe age of forty-four years in which this paper has done a wonderful work for the machine tool industry in America and also throughout the World.

"We have been advertising in the

uous Advertising

American Machinist ever since we commenced business and we feel that a great portion of our success is due to the publicity obtained through this publication. The best proof of our complete satisfaction is the fact that we increased our advertising with you this year from one to two pages per issue."

Mr. L. E. Honeywell,
Advertising Manager,
The National Acme Company.

"From our standpoint, the American Machinist is to the user of machinery and tools as the teacher is to the school boy, or as the newspaper is to the community it serves.

"In other words, to us it is a medium through which the advertiser may educate his customers and prospects as to the purpose, new developments and specific efficiency of the product he offers.

"The fact that we have been using the American Machinist for more than twenty years should in itself indicate our belief that it performs its part well as a medium."

Mr. Harry W. Champion, *President,*
Newton Machine Tool Works, Inc.

"My personal regard for the American Machinist has always been very high.

"I believe that in our line of business that it is almost part of your fixed charges to carry an advertisement in your paper, and I feel that we reach a very large field of our customers through your paper."

Mr. F. H. Deisher,
President and Treasurer,
Royersford Foundry & Machine Company, Inc.

"It has been a pleasure to have been one of your customers for twenty consecutive years, during which time the service has been everything we could expect and the results very satisfactory. Many of our inquiries from foreign countries read, "We saw it in the American Machinist."

Mr. A. G. Spencer,
Vice President and General Manager,
The Safety Emery Wheel Company.

"As you state, we have been continuous advertisers in this journal twenty years or over and we have always had good service and satisfactory results. Otherwise, we would not have continued with you as long as we have.

"If we ever have occasion to cut down our line of advertising, we know that the American Machinist would be the last medium we would think of discarding. "You would have to treat us very shabby indeed to cause us to discontinue advertising in the American Machinist."

Mr. Robert B. Skinner,
Assistant Secretary,
The Skinner Chuck Company.

"Having advertised in the American Machinist for a period of over twenty years and finding the results so far as they can be ascertained, very satisfactory, we are taking this occasion to express our appreciation for the services received from your organization and particularly from your New England Manager, Mr. Fred S. Weatherby.

"When business a few months ago made it seem advisable to curtail our advertising appropriations, one of the last papers to feel the reduction was the American Machinist. We would not consider discontinuing our advertising in this paper as long as we continued to manufacture and sell Skinner Chucks."

Mr. Donald McSkimmon,
J. T. Slocomb Company.

"The writer wishes to say that he has always considered the American Machinist the foremost medium of its type published.

"As you know, we have advertised in your paper for over twenty years and we feel that we have been amply repaid for whatever expenditures we have made because of the fact that we have secured many new accounts in one way or another thru our advertisements. Not only have we been successful in obtaining new accounts from manufacturers and dealers, but also from toolmakers, machinists and the like who request catalogs and literature stating, "I saw your ad in the American Machinist." We have every reason to believe that we shall have further inquiries from time to time thru our advertisements in your paper.

"In conclusion, we wish to say that we heartily recommend the 'American Machinist' as an advertising medium for all concerns in any way connected with the metal trades not only for its advertising possibilities, but also for the extremely interesting articles which appear in each issue."

Mr. J. E. Mills, *President,*
The Smith & Mills Company.

"We have been advertising in the American Machinist for something over twenty years, and have always found this medium of constantly keeping our tools before the trade very successful. In fact, we could trace direct results of advertising in your paper if we cared to take the trouble of going over our records, and we think a great deal of credit is due you for the splendid manner in which our products have been so long displayed."

Mr. C. E. Whitney, *President,*
The Whitney Mfg. Company.

"You, of course, know that we have a high regard for your Journal. The many years we have been with you is alone a strong endorsement."

Mr. Hugh Alkman,
Publicity Manager,
J. H. Williams & Company.

"For nearly a quarter of a century our advertisements have appeared regularly in the American Machinist. We have always regarded this publication very highly and shall continue to give it a preferential position on our list of advertising media for we are confident it reaches a class of trade very valuable to us. The fact that for so many years we have consistently used space in your magazine speaks louder than words as to our opinion of its importance to us."

Mr. Horace P. Dix,
Secretary and General Manager,
Wilmarth & Morman Company.

"Good advertising copy, made up well in advance (copy which presents something other than a picture of the manufacturer's product over the manufacturer's name and address) will bring home results, and the American Machinist is naturally a logical source for machine tool manufacturers and manufacturers of machinery accessories to present their publicity."

Mr. E. M. Woodward,
President and Treasurer,
Woodward & Powell Planer Co.

"The writer of this letter has been acquainted with the American Machinist from its infancy, when it was three years old.

"Having advertised in the American Machinist for over twenty years, it is self-evident that we believe that the American Machinist is one of the best mechanical papers in which to advertise our line of metal working machinery."

BAUSH METAL
DURALUMIN

A Few Advantages

MACHINING

Better than aluminum.

Cost greatly reduced when compared with iron or steel.

Taps and threads well.

RECIPROCATING PARTS

Weight reduced without loss of strength.

Acceleration increased.

Inertia decreased.

Polishes easily.

Resists atmospheric conditions.

No plating required.

Can be rolled, forged, drawn, heat treated and annealed.

Hot and cold worked.

A QUALITY METAL

Duralumin is an alloy produced after years of systematic endeavor to meet the demand for a metal which shall be as light as Aluminum and as strong as mild steel, yet without the many disadvantages of Aluminum in its pure state.

Duralumin is the only light metal that can replace steel in forgings. With a two-thirds saving in weight, heat treated Duralumin Forgings approximate mild steel forgings in strength.

Wherever weight is a deciding factor Duralumin is the most satisfactory metal for most articles made by hot working or forging. Naturally, Duralumin Forgings are especially desirable for reciprocating or moving parts where inertia, due to their own weight, forms a large part of the total stress.

Minimum Physical Properties of Rolled or Sheet Metal (heat treated) and of Forging Metal are:

Tensile	55,000 lbs. per sq. inch
Elastic Limit	30,000 lbs. per sq. inch
Elongation	18%

BAUSH MACHINE TOOL COMPANY

Metals Division

SPRINGFIELD, MASS., U. S. A.

Manufacturers of

BAUSH
DURALUMIN

BLOOMS—SLABS—BILLETS—SHEETS—FORGINGS

BAUSH CASTING METAL INGOTS

Aluminum Alloy of High Tensile Strength

Rolling Mill and Drop Forge Works
SPRINGFIELD, MASS.

Detroit Office:
1825 Dime Savings Bank Bldg.

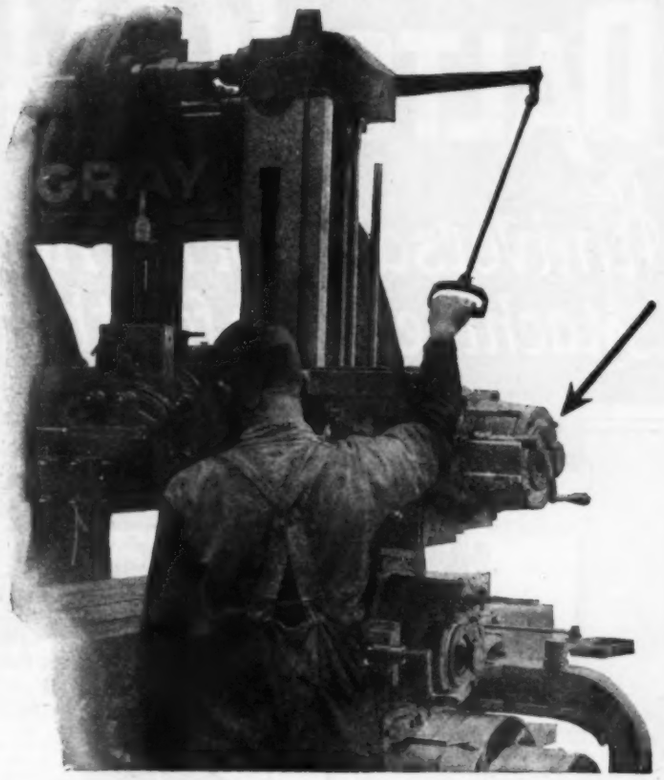
THE NEW GRAY MAXIMUM SERVICE PLANERS

"RAIL-LOCK"

(Patent applied for)

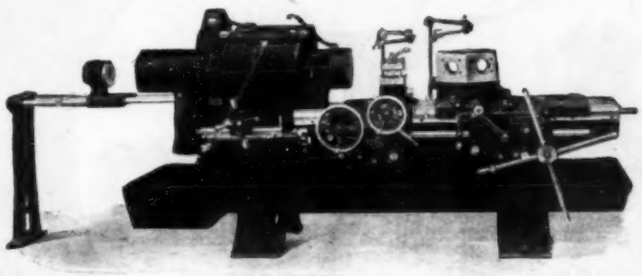
Turning the crank locks the rail firmly and equally to the inside of both housings. This stiffens the rail by shortening the length subject to torsion.

On old style planers the operator had to walk around the planer to loosen the clamp on the rear side. Why waste time walking around the planer?

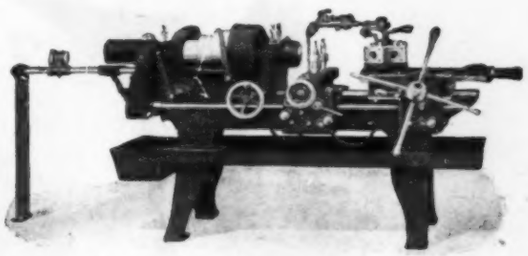


This and a dozen other important productive features are described in our new catalog. Send for your copy.

The G. A. Gray Co.
Cincinnati, Ohio



Foster Univ. Turret Lathes—3 Sizes



Foster Screw Machines—5 Sizes

W. A. Barker Wrenchless Chuck

Every moment and movement productive

Each and every machine of the "Foster" line has established a reputation of winning complete and instant acceptance on its first showing.

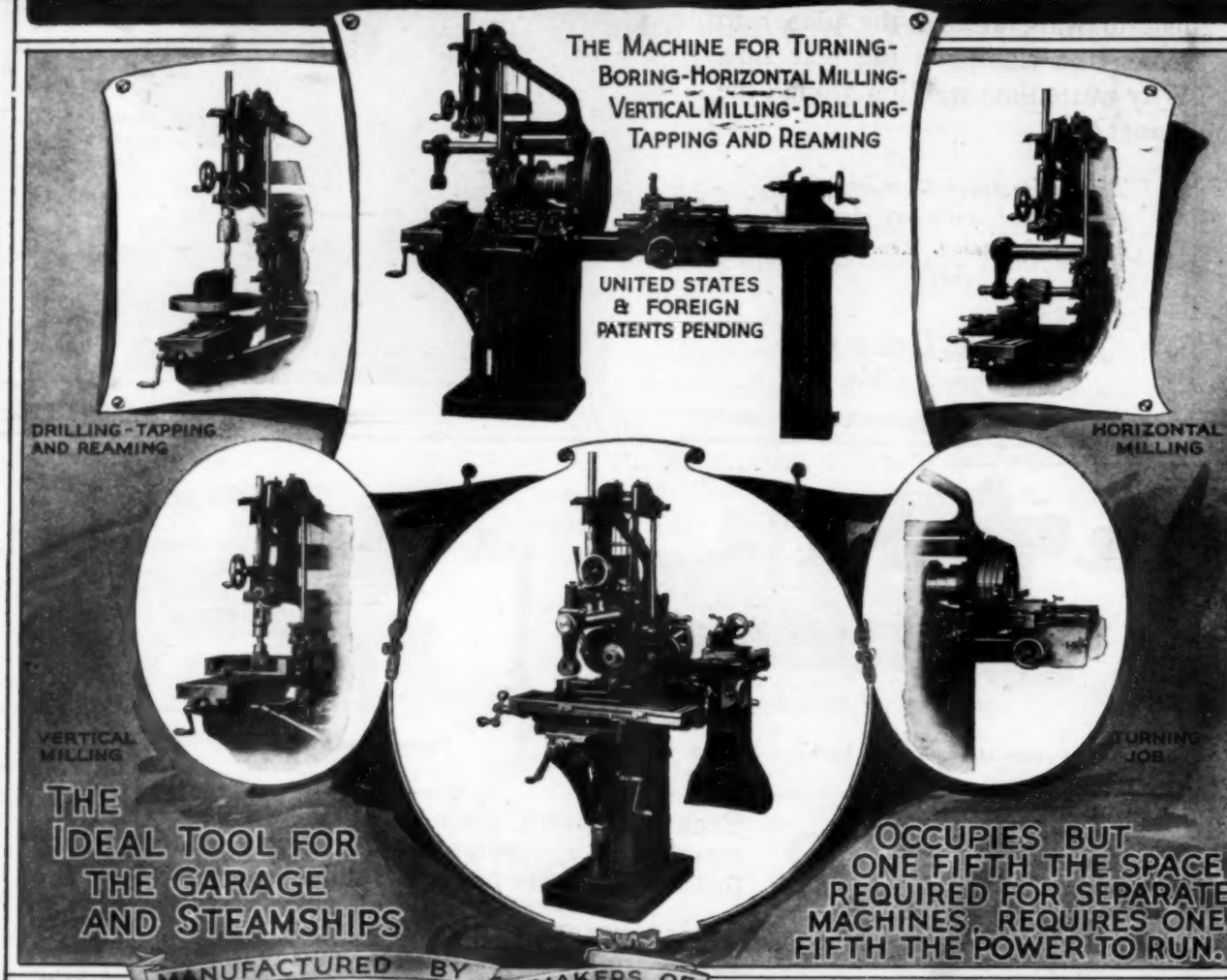
Their elements of exceptional value as money and time savers are bound to impress you favorably and forcefully. They have already done so to scores and hundreds of users.

Our engineers are constantly solving production problems. It's their job. Why not submit blue prints of some of your tough jobs? It's well worth while, and puts you under no obligation whatsoever.

FOSTER MACHINE CO., Elkhart, Indiana

DALTON COMBINATION

The Universal Tool for Repairs, and the Complete Machine Shop for the Small Manufacturer.



THE IDEAL TOOL FOR THE GARAGE AND STEAMSHIPS

OCCUPIES BUT ONE FIFTH THE SPACE REQUIRED FOR SEPARATE MACHINES. REQUIRES ONE FIFTH THE POWER TO RUN.

MANUFACTURED BY THE MAKERS OF

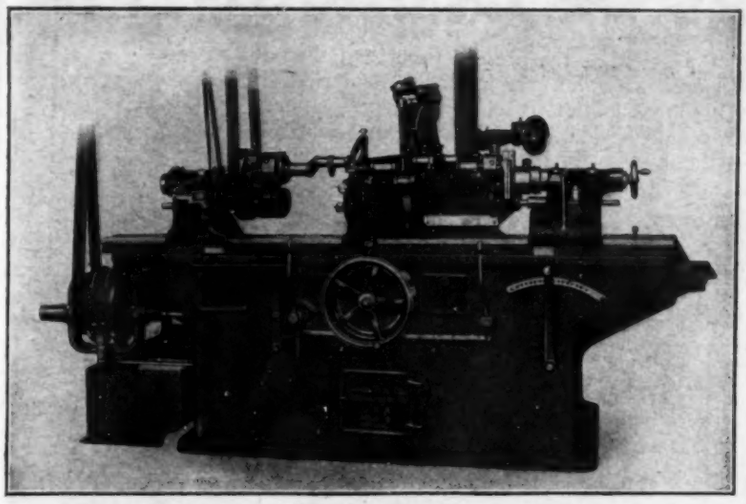
"THE SMALL LATHE FOR THE BIG JOB"

DALTON MANUFACTURING CORP.

SOUND BEACH, CONN.

CABLE ADDRESS "ALEDAL"—STAMFORD, CONN. U.S.A.

The Careful Motorist Asks: "Have you a Landis?"



Getting the entire motor overhauling job done under one supervision is a mighty big advantage.

It saves the car owner valuable time by preventing several trips to various shops that are equipped to replace and repair certain parts only.

The **Landis 4-A Special Grinding Machine** gives you complete grinding equipment in a single unit. It grinds crank shafts, pistons, wrist pins, piston rings, valves, valve stems, transmission gears, etc.

Your business will increase from the day you install the

LANDIS

No. 4-A Special Grinding Machine

See Exhibit at the New York Automobile Show.

LANDIS TOOL COMPANY, Waynesboro, Pa.

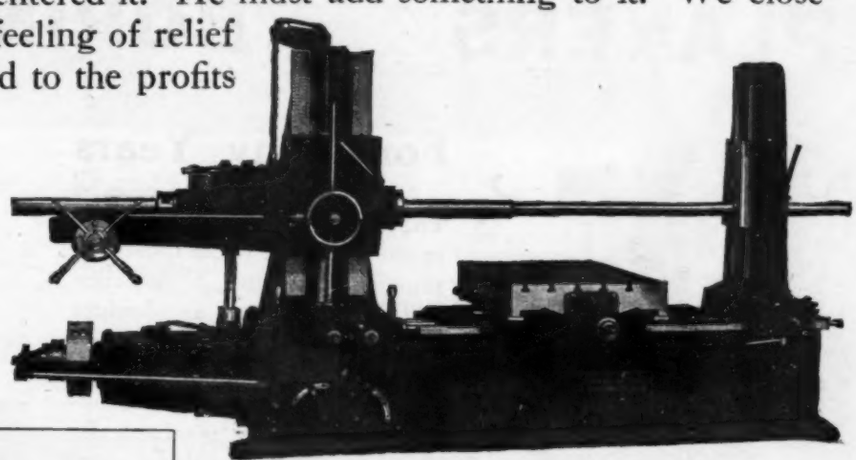
New York Office: 51 Chambers St.

DOMESTIC AGENTS—Hallidie Machinery Co., Seattle; Harron, Rickard & McCone, San Francisco and Los Angeles; Seeger Machine Tool Co., Atlanta. **CANADIAN AGENTS**—A. R. Williams Machinery Co., Toronto; Williams & Wilson, Ltd., Montreal. **FOREIGN AGENTS**—Allied Machinery Co., Paris, Turin, Barcelona, Brussels, Zurich and Lisbon; Andersen, Meyer & Co., Ltd., Shanghai; Andrews & George Co., Ltd., Tokyo; Benson Brothers, Sydney and Melbourne; Burton, Griffiths & Co., Ltd., London; Wilh. Sonesson & Co., Malmo and Copenhagen.

No man has the right

to end the year as he entered it. He must add something to it. We close the 1921 book with a feeling of relief because we have added to the profits of the users of the

"PRECISION"
Boring, Drilling and MILLING MACHINE



WE ALSO MAKE THE

LUCAS POWER Forcing Press

Lucas Machine Tool Co.

Cleveland, Ohio

NOW AND ALWAYS OF

AGENTS

Alfred Herbert, Ltd., Coventry; Societe Anonyme Belge, Alfred Herbert, Brussels; Aux Forges de Vulcain, Paris; Allied Machinery Co., Turin, Barcelona, Zurich; Benson Bros., Sydney, Melbourne; V. Lowener, Copenhagen, Christiania, Stockholm; R. S. Stokvis & Zonen, Rotterdam; Andrews & George Co., Tokyo.

CINCINNATI-ACME

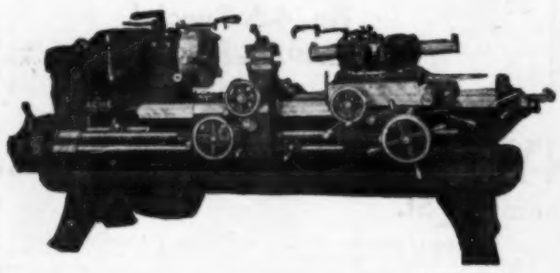
The Message of Economy

There is surely no more important problem at the present time than that of **economy in production.** We can offer you an immediate solution of this problem. On multi-operation jobs, Cincinnati-Acme Turret Machinery (Flat Turret Lathes, Turret Lathes and Screw Machines) can **unquestionably** cut the cost of production to the bone. The saving in time and labor is enormous.

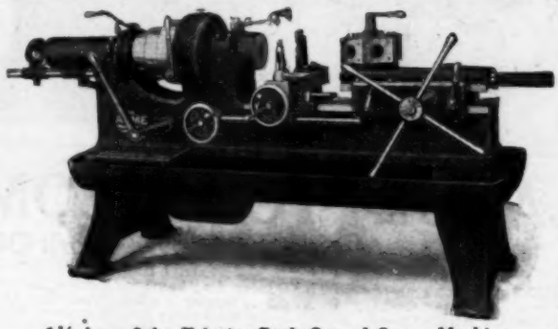
Let us help you make more money.

Write for "Cincinnati-Acme Efficiency" today

The ACME Machine Tool Co., Cincinnati, Ohio, U. S. A.

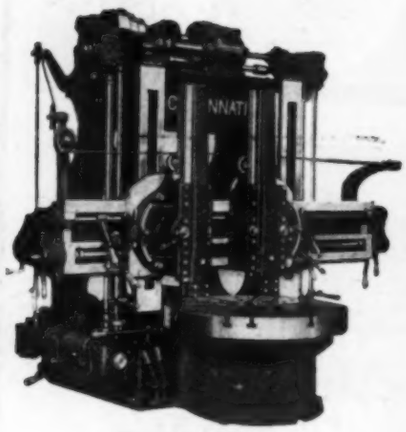


Cincinnati-Acme No. 3 Universal Flat Turret Lathe



1½ in. x 9 in. Friction Back Geared Screw Machine

CINCINNATI
PLANERS *Original Thru out* BORING MILLS

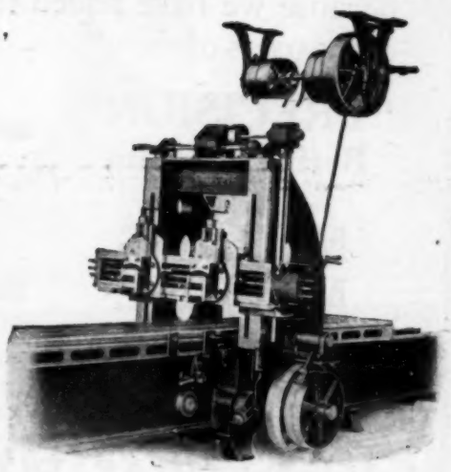


Sizes 42 in. to 12 ft.

For Many Years

The improvement recently made in the design of these tools will remain new—and then—they will be recognized as absolute requirements. We believe in ease of operation, relieving operator of responsibility for upkeep, and doing mechanically that which is usually done physically.

Our catalog tells the whole story.

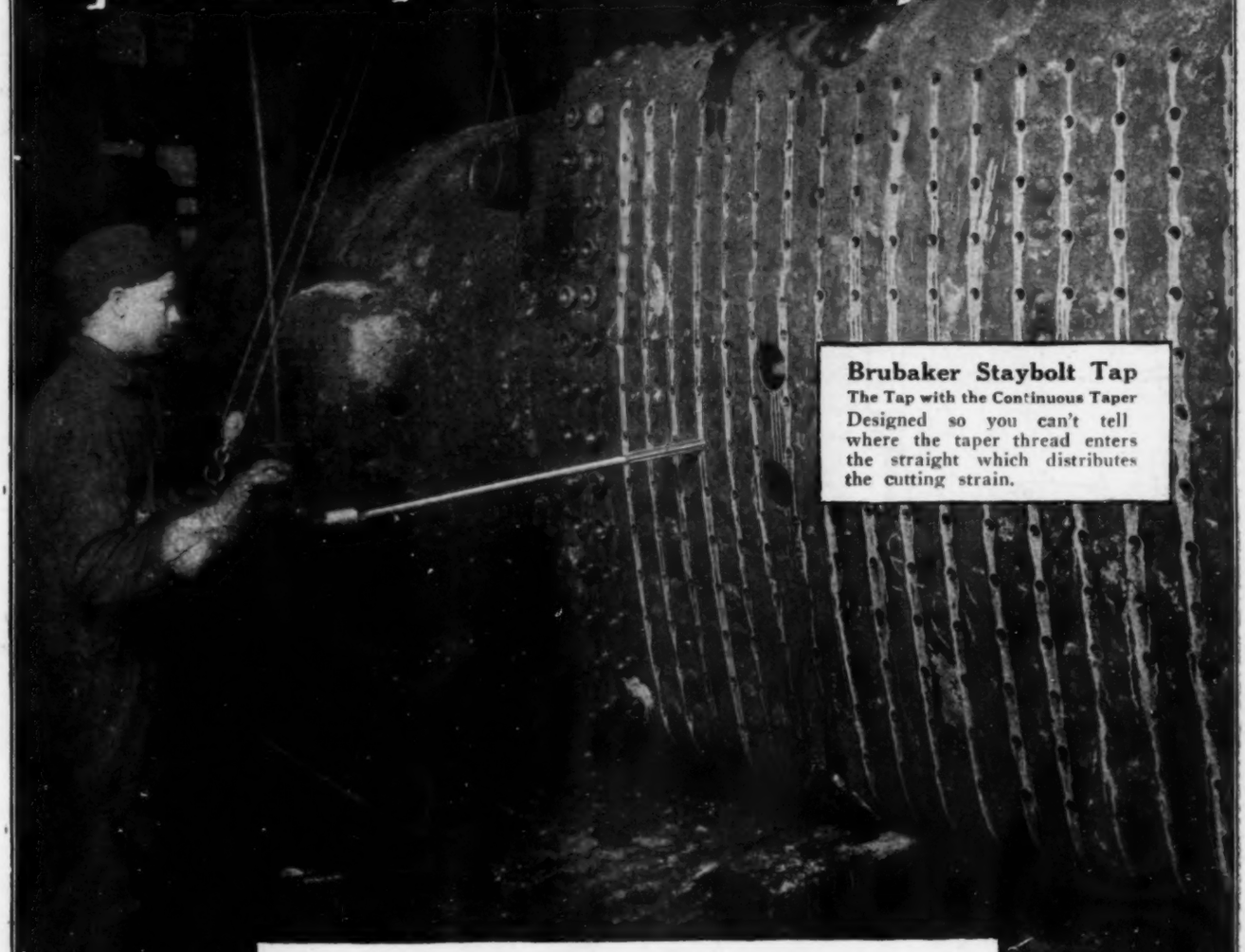


Standard Sizes 22 in. to 120 in.
Open Side Planers 30 in. to 72 in.

The Cincinnati Planer Co.
Cincinnati, Ohio, U. S. A.

BRUBAKER

Special Tempered Relieved Staybolt Taps



Brubaker Staybolt Tap
The Tap with the Continuous Taper
Designed so you can't tell where the taper thread enters the straight which distributes the cutting strain.

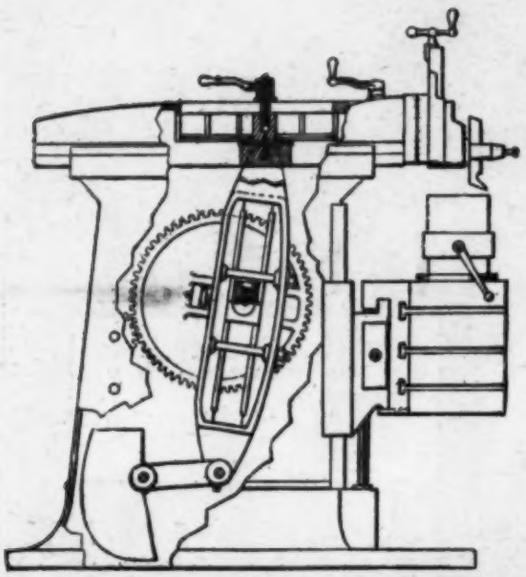
Beginning Right

Start the youngster with right tools, and he'll rise to be a credit to his craft. **Brubaker Staybolt Taps** are right. They are tempered with scientific skill and possess a relief that insures clean, free cutting.

The highest motor speeds are possible, thus more holes are tapped per shift. If you are interested in a tap that will give a full 20% more holes, get in touch with us.

W. L. BRUBAKER & BROS. CO.
50 Church Street **New York**
Factory: Millersburg, Pa.

A High Class Shaper with an Exceptional Feature



AVERBECK

The best shaper buy on the market today—because—
In design and construction it is as fine a shaper as any manufactured.

It has a patented feature that reduces materially the power consumed and makes faster speeds possible.

It is counterbalanced and operates as smoothly as a balanced engine.

Investigate. Write for full details today.

The Steel Products Engineering Co.
Springfield, Ohio, U. S. A.

SALES REPRESENTATIVES:
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W. J. Baird Machinery Co., Detroit, Mich.
McCoy-Brandt Machinery Co., Pittsburgh, Pa.
Scott-Bansbach Machinery Co., Chicago, Ill.
The Day Machinery Co., Buffalo, N. Y.
M. J. Walsh Machinery Co., Milwaukee, Wis.

STANDARD GAUGE STEEL

For 30 years

Many firms can look back to the date when they began to use STANDARD GAUGE COLD DRAWN STEELS.

Likewise, we can look back upon three decades of service to America's largest and most critical buyers of steel.

There is just one reason—our products and our service can't be surpassed.

Our up-to-date equipment is at your service

Cold Drawn Steel and Steel Products that have built up a Notable Name for DEPENDABILITY.

Critical Buyers continue to place orders here because they find our steel products consisting of cold drawn steel, machine keys, machine racks, elevator guides, crankshafts and connecting rods can't be surpassed.

STANDARD GAUGE STEEL COMPANY
Beaver Falls, Pennsylvania
DISTRICT OFFICES:
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611 Harrison Bldg., Philadelphia, Pa.
1503 Kresge Bldg., Detroit, Mich.
REPRESENTATIVES:
P. F. McDonald & Co., Boston, Mass.
Rolph Mill & Co., San Francisco, Cal.
A. Campbell White, New Orleans, La.
Aborn Steel Co., New York City.

OUR CATALOG IS COMPLETE —ASK FOR IT

A New
Drill for a
Neglected
Field
MEZZO

A New Drill for a Neglected Field

FOR YEARS there has been a neglected field to which drill manufacturers have not given sufficient attention. This field is the shop which could not obtain production with Carbon Drills and yet was not equipped to realize full efficiency from High Speed Drills, and therefore could not use them satisfactorily.

These shops demanded a drill which would stand higher speeds and feeds, give far greater drilling capacity than Carbon Drills and still sell at a moderate price.

To meet this demand, we present

MEZZO

Heating the cutting edge of "MEZZO" even to a dark blue color will not draw its temper. "MEZZO" works at its best efficiency this way.

"MEZZO" was developed after months and months of research involving not only the use of a new steel but also new hardening and heat treating processes.

We believe that we have extended our leadership into a new field—but not with an untried product.

"MEZZO" has been tested and re-tested—a drill on which we are proud to place our name.

Write for the *"Story of Mezzo."* It is a most interesting little booklet which gives full information on "MEZZO" and its uses.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND
NEW YORK - CHICAGO - LONDON

TRADE MARK REG. IN U. S. AND FOREIGN COUNTRIES

COLBURN

No. 2 Manufacturing Heavy Duty Drill Press

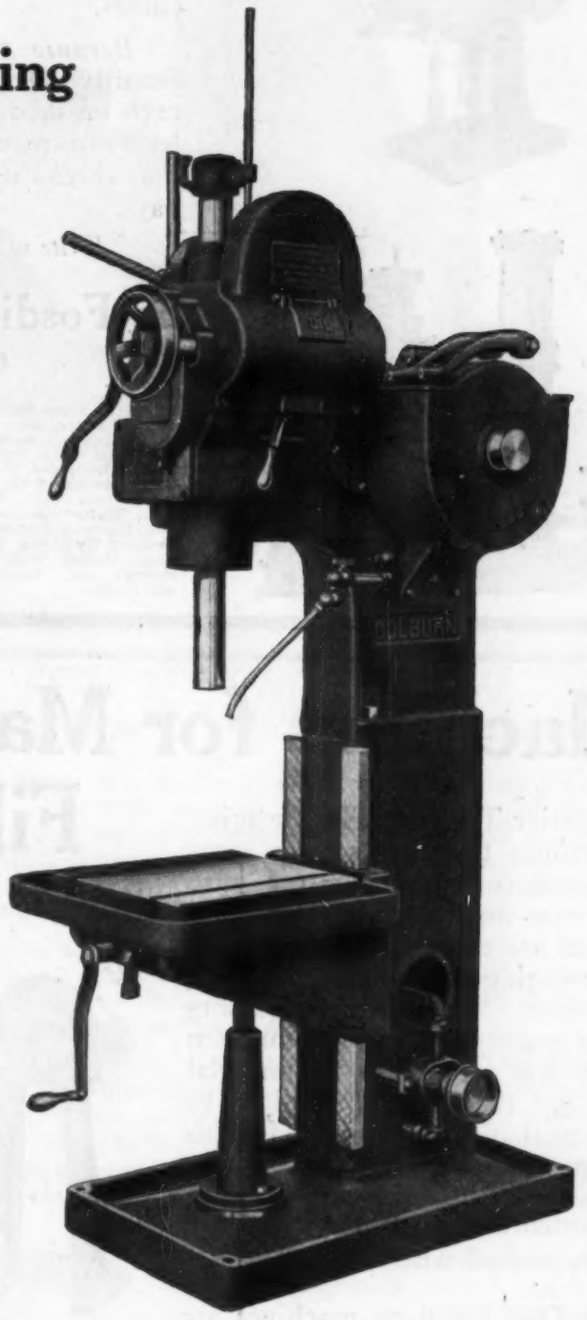
This machine is essentially a production tool for duplicate operation work. It is being used with great success in automotive and accessory plants where accuracy and rapid production are essential.

However, it is not a single purpose machine due to the *patented* feed and speed transposing gear feature which gives an unlimited number of feed and speed changes by simply using different combinations of gears. The feed gears are located at the front and the speed gears at the side of the machine, convenient for the operator.

The No. 2 is built singly or in gangs of two, three and four spindles. In operation each head is driven and controlled independently.

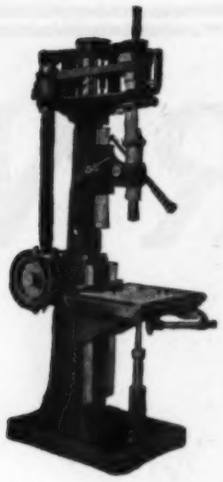
Capacity up to 1¼ in. in solid steel.

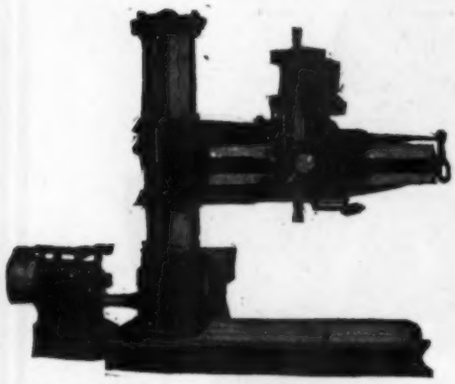
Swing 20 inches.



Bulletins giving a complete description and illustrating the features of this or any of the other types of Colburn Heavy Duty Drill Presses will be sent upon request. No obligation.

THE COLBURN MACHINE TOOL COMPANY
1038 IVANHOE ROAD, CLEVELAND, OHIO
Builders also of Colburn Boring and Turning Mills





FOSDICK

THIS mark is a little thing to look for, but it's a *big thing to find* on Drilling and Tapping Machines.

Because every detail in the making of FOSDICK Sensitive Drills and Radials is carefully worked out—each finished machine is thoroughly tested—the excellent workmanship and finish make a finished product that checks up right in service. Buy by the mark, it pays.

Write us or our nearest agent for further information

The Fosdick Machine Tool Company

Cincinnati, Ohio, U. S. A.

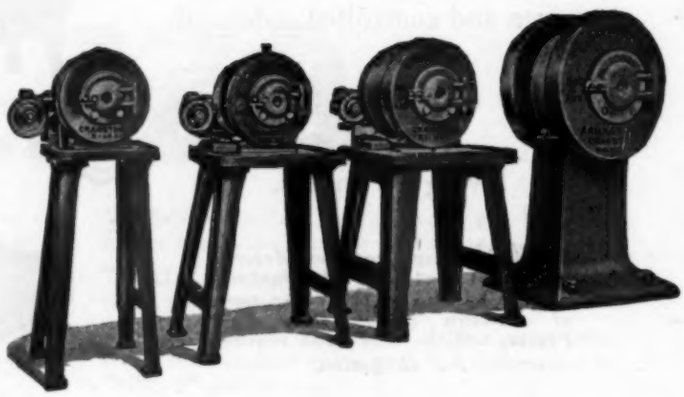
AGENTS: Biggs-Watterson Co., Cleveland, Ohio; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; Eccles & Smith Co., San Francisco, Calif., Los Angeles, Calif., Portland, Ore.; Barbour, Love & Woodward, New York, N. Y.; E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind.; Peninsula Machinery Co., Detroit, Mich.; Homer Strong, Rochester, N. Y., Buffalo, N. Y.; H. A. Smith Machinery Co., Syracuse, N. Y.; Swind Machinery Co., Philadelphia, Pa.; (Somers, Fitler & Todd Co., Pittsburgh, Pa., for Radials only); Stocker-Rumely-Wachs Machinery Co., Chicago, Ill.; Milwaukee, Wis.; Taylor Machinery Co., Boston, Mass.; A. R. Williams Machinery Co., Toronto, Ont., Canada; Burton Griffiths & Co., London, England; Fenwick Freres & Co., Paris, France; Wynmalen & Hausmann, Rotterdam, Holland; Rylander & Asplund, Stockholm, Sweden; Wilh. Sonesson & Co., Malmo, Sweden, Copenhagen, Denmark; Alfred Herbert, Ltd., London, England, for Japan, Manchuria, Korea, Formosa, Burmah and Ceylon.

Machines for Making Tungsten Filament Wire

Langelier Tungsten Hot Swaging Machines take the square ingot and reduce it the required wire size to as small as .018. These machines are especially designed for the swaging or reducing of tungsten wire. We have been making these machines ever since tungsten wire has come into commercial use and they have proved to be practical and most efficient for this purpose.

Automatic Wire Roller Feed can be furnished when desired.

The Dies for these machines are made of High-Speed Steel and we will furnish additional Dies for our machines at any time promptly.



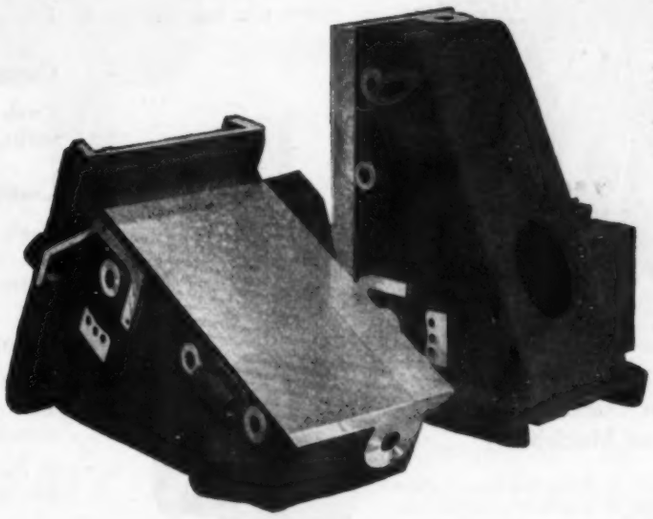
If you are interested in making Tungsten Filament Wire it will pay you to investigate these Langelier Tungsten Hot Swaging Machines.

LMCo.

LANGELIER MANUFACTURING COMPANY

Arlington, Cranston, R. I., U. S. A.

MILWAUKEE MILLING MACHINES



The Solid Top Knee—

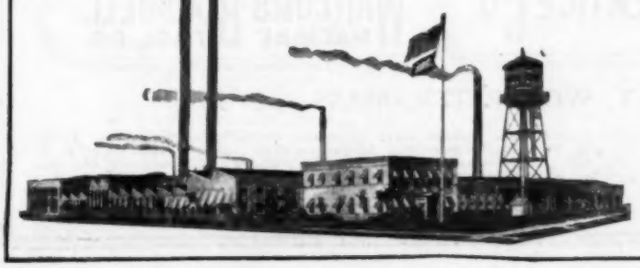
and how it adds to the rigidity and gives greater strength to the Milwaukee Milling Machine

The knee of a milling machine is subject to great strain. Not only must it sustain the weight of the saddle, table and work being machined as well as the downward thrust caused by the action of the cutters, but in cases where the cutter is operating high above the table it is also subjected to twisting strains.

In many cases the twisting strain is greater than the down thrust of the actual weight imposed. So the knee, then, should be sufficiently strong to withstand both the downward thrust and twisting strain.

With this point in view, the Box Section, Solid Top Knee of the Milwaukee was designed. All engineers know that a box section resists torsional strain better than any other form. And the Solid Top has no slots or holes to close and impair alignment. It also prevents dirt and chips from entering the mechanism within the knee.

Let us tell you of the other advantages of Milwaukee Milling Machines. Send for catalogues.



KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS., U.S.A.

CHICAGO OFFICE 631 WASHINGTON BLVD. CLEVELAND OFFICE 738 SUPERIOR AVE. N.W. NEW YORK OFFICE 50 CHURCH STREET

THE JOHNSON FRICTION CLUTCH

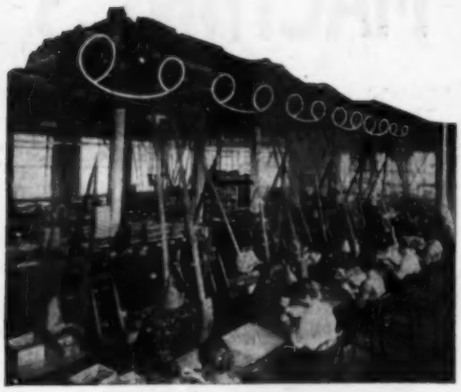


Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

It's a Johnson Line Shaft Drive

A battery of twelve light presses, all on a bench about 30 x 5 driven from one line shaft with Johnson Clutches controlling the machines.

Compare It for First Cost

Twelve clutches against twelve complete countershafts, or twelve individual motors.

Compare It for Efficiency

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

Compare It for Service

You know the failings of belts—the continual attention they require, especially when they are shifted.

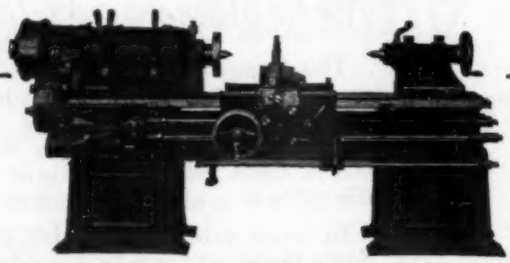
If you don't know Johnson Clutch Service, just give it a trial.

Friction Control Means Better Machinery

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard Clutches available from stock, and special models developed to suit conditions.

Write for our Stock List and Blue Catalog.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN



WHERE EXTREME ACCURACY IS REQUIRED

As concerns tool equipment, the trend of the times points only in one direction and that is to the absolute necessity of using modern machine tools of the highest producing value.
Reed-Prentice Geared Head Lathes are entirely modern in design and give the production that conditions demand. Furthermore they will meet the most exacting standards of accuracy and durability.
They are built in sizes from 12 in. to 27 in. and can be arranged for belt or gear connected motor drive.

LATHES—PLANERS—MILLING MACHINES—MILLING CUTTERS—RADIALS—VERTICAL SURFACE GRINDERS—PORTABLE SHAPERS

BECKER-MILLING MACHINE COMPANY | **REED-PRENTICE CO.** | **WHITCOMB-BLAISDELL MACHINE TOOL CO.**

677 CAMBRIDGE STREET, WORCESTER, MASS.

Sales Offices: Cleveland, Indianapolis, Detroit, New York. *Agents:* Dale Machinery Co., Chicago, Ill.; Normoyle & Lapp, 514 Liberty Bldg., Philadelphia, Pa.; M. D. Larkin Supply Co., Dayton, Ohio; O. R. Adams, Buffalo and Rochester, N. Y.; H. A. Smith Machinery Co., Syracuse, N. Y.; W. M. Pattison Supply Co., Cleveland, Ohio; McCoy-Brandt Machinery Co., Pittsburgh, Pa.

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Sales Offices and Agents have stock of cutters for prompt deliveries

13 in. x 4 ft.
"Star"
"Short Cut" Lathe
Style A

It's the Busiest Machine in the Shop

TAKE a survey of your products and you will find that a majority of them are under 7¾ in. in diameter and less than 19 in. long. All such turning work can be profitably produced on the **"STAR" Short Cut Lathe.**

In the majority of shops the **"STAR" Short Cut Lathe** will readily produce more than 50% of the duplicate part work ordinarily put on larger machines.

It offers the greatest possibilities for the investment.

The **"STAR" Short Cut Lathe** has maximum power and covers an extremely wide range.

This machine can be supplied fully equipped with tools ready for work. No hold-ups waiting for tools.

Built to Endure
They have—
They do—
They will

Star Short Cut Lathe

Write us your problems. We are also manufacturers of the famous line of "STAR" Lathes.

The Seneca Falls Mfg. Co., Inc.

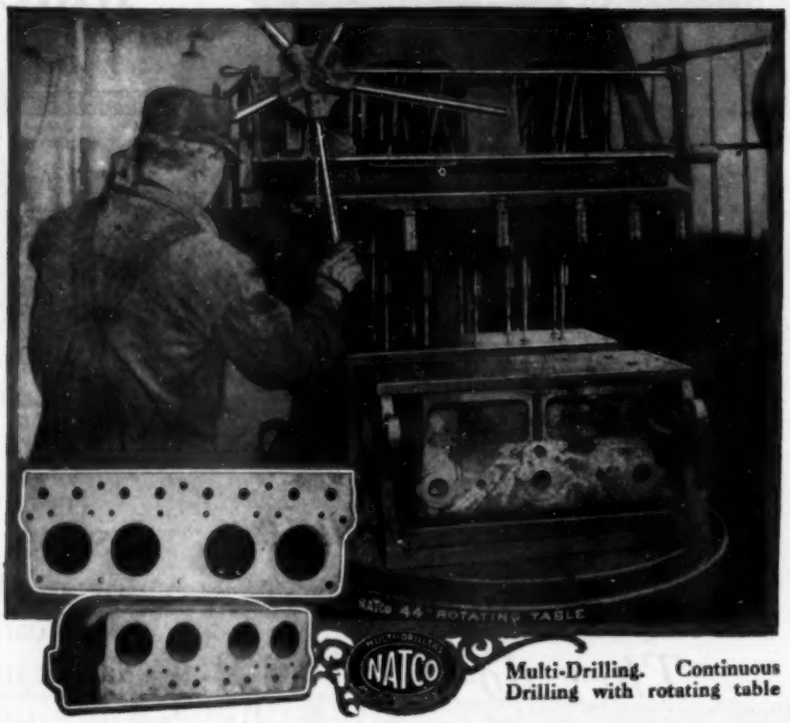
387 Fall St., Seneca Falls, N. Y.

Exclusive Agents for Short-Cut Lathes

Ogden R. Adams, Syracuse, N. Y.; Ogden R. Adams, Rochester, N. Y.; Ogden R. Adams, Buffalo, N. Y.; Blackman-Hill McKee Company, St. Louis, Mo.; Cameron & Barkley Company, Jacksonville, Fla.; Coghlin-Kirkby Machinery & Supply Co., Toledo, Ohio; Eccles & Smith Company, San Francisco, Calif.; The English Tool & Supply Company, Kansas City, Mo.; Marshall & Huschart Machinery Company, Chicago, Ill.; The Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; The Lynd-Farquhar Company, Boston, Mass.; Northern Machinery Company, Minneapolis, Minn.; The Perine Machinery Company, Seattle, Wash.; F. C. Richmond Machinery Company, Salt Lake City, Utah; The Seifreat & Woodruff Company, Dayton, Ohio; The Sherritt & Stoer Company, Philadelphia, Pa.; Smith-Booth-Usher Company, Los Angeles, Calif.; The Gang Machinery Company, Cincinnati, Ohio; Somers, Fitler & Todd Company, Pittsburgh, Pa.; Standard Machinery Company, New Haven, Conn.; Strong, Carlisle & Hammond Company, Cleveland, Ohio; Strong, Carlisle & Hammond Company, Detroit, Mich.; Messrs. Kernan & Swift, 45 West 18th St., New York City.

MULTI-DRILLERS NATCO THE WHOLE STORY IN ONE WORD **MULTI-TAPPERS**

Do You Know



Multi-Drilling. Continuous Drilling with rotating table

That the NATCO Multi-Driller is the only machine with Patented Independent Change of Speed to each Individual Drill? This patented feature permits the drilling of different size holes at the same operation, each spindle running at its correct cutting speed.

That the NATCO has one nut Adjustable Arms?

That the NATCO has patented Universal Joints?

That the NATCO has three speed changes and sliding gear transmission running in oil?

That the NATCO has six changes of feed for each spindle speed?

That the NATCO is equipped with HYATT High Duty Roller Bearings?

That the NATCO may be equipped with special Cluster Plate, Box, or Rotating Table?

That the NATCO will Drill, Tap, Spot-face, Ream or Counterbore? A machine particularly adapted to all classes of work.

That the NATCO can be used for either Drilling or Tapping?

That competition is increasing in your line the same as in every other line, and costs must be cut down to meet this competition?

NATCO Multi-Drilling and Tapping will reduce your costs as it has those of hundreds of ***NATCO*** users.

Send us your blue prints and we shall be glad to submit propositions for your approval; or write us if interested, and we will have a ***NATCO*** representative call and make a study of your drilling and tapping requirements without any obligation on your part.

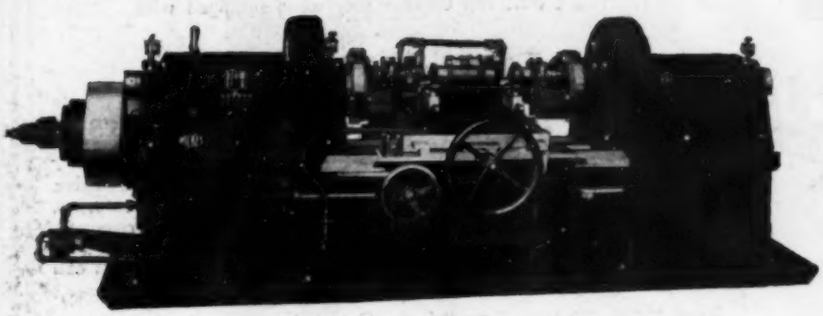
Fixtures in connection with NATCO Multi-Drillers and Tappers made by NATCO if desired.

The National Automatic Tool Company, Richmond, Ind., U. S. A.

Largest exclusive manufacturers of Multi-Drillers and Multi-Tappers

The Wickes Duplex Crankshaft Lathe

Designed for Turning Two Pins Simultaneously



The Wickes Duplex Crankshaft Lathe is designed for turning two pins simultaneously. It is similar in all respects to the Universal Type, aside from the fact that it is a specialized machine for this class of work. It is furnished with complete equipment, tooled up for your job.

Wickes Brothers

220 Water Street, Saginaw, Michigan
501 Fifth Ave., New York
736 White-Henry Bldg., Seattle, Wash.

Builders of

Heavy Duty Plate and Structural Tools, Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment, Blueprint Machines.

WICKES

"BLANCHARDIZING"

Do *You* Know What It Means?

Cut this off and mail it to us.

.....
(Date)

THE BLANCHARD MACHINE CO.
64 State Street,
Cambridge, Mass.

Gentlemen:

I should be pleased to receive a copy of the Blanchard Grinder Data Book, showing fifty examples of "Blanchardized" work and giving production data obtained in shops of users.

Yours very truly,

.....

Address.....

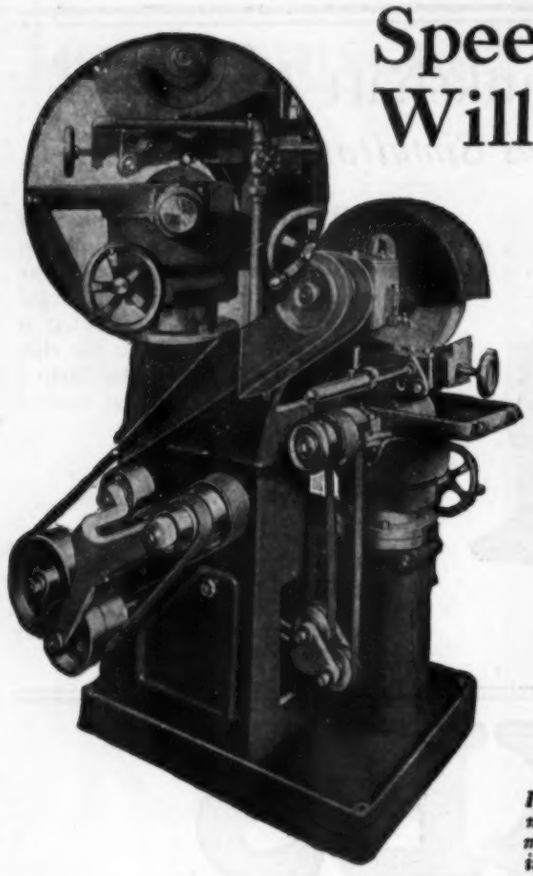
.....

American Machinist—12-29-21

REPRESENTATIVES:

UNITED STATES: Henry Prentiss & Co., Inc., Motch & Merryweather Co., Marshall & Huschart Machinery Co., W. E. Shipley Machinery Co., Kemp Machinery Co., Robinson, Cary & Sands Co., Pacific Tool & Supply Co., The Hendrie & Bolthoff Manufacturing & Supply Company. CANADA: Williams & Wilson, Ltd., F. F. Barber Machinery Co. GREAT BRITAIN: C. W. Burton, Griffiths & Co. FRANCE: Aux Forges de Vulcain. ITALY, SWITZERLAND, BELGIUM, SPAIN and PORTUGAL: Allied Machinery Co. of America. SWEDEN: A. B. Rylander & Asplund.

Speed and Precision Will Gain the Contracts



The one way to meet competitive figures on cylindrical grinding work is to produce more parts of a better quality per hour. We know of many instances where machine shop proprietors have been asked to bid on short-time contracts because they were equipped with

Detroit No. 4
Heavy Duty Centreless Grinders

This new machine possesses many up-to-the-minute features. Positive rotation of work at all times. Three work rotating speeds to select from. It grinds the work only when there is metal to be removed, supporting the work accurately as it is being ground. Any speed or feed which you found best when grinding work between centers can be obtained in this machine.

From 200 to 500 feet of work is the Detroit hourly production. There is a Detroit representative in your vicinity. Let him give you full data.

DETROIT MACHINE TOOL CO.,
6523-45 St. Antoine St., Detroit, Mich., U. S. A.

If you would learn more about the machine having an hourly metal removing capacity of 60,000 sq. in., get in touch with us.

Yours for Smoother Operation

Hundreds of manufacturers know that machines incorporating cam movements can be made more efficient by insisting that designers specify

Rowbottom for Cams

The Rowbottom Universal Cam Milling Machine cuts cams to the closest tolerances in minimum time.

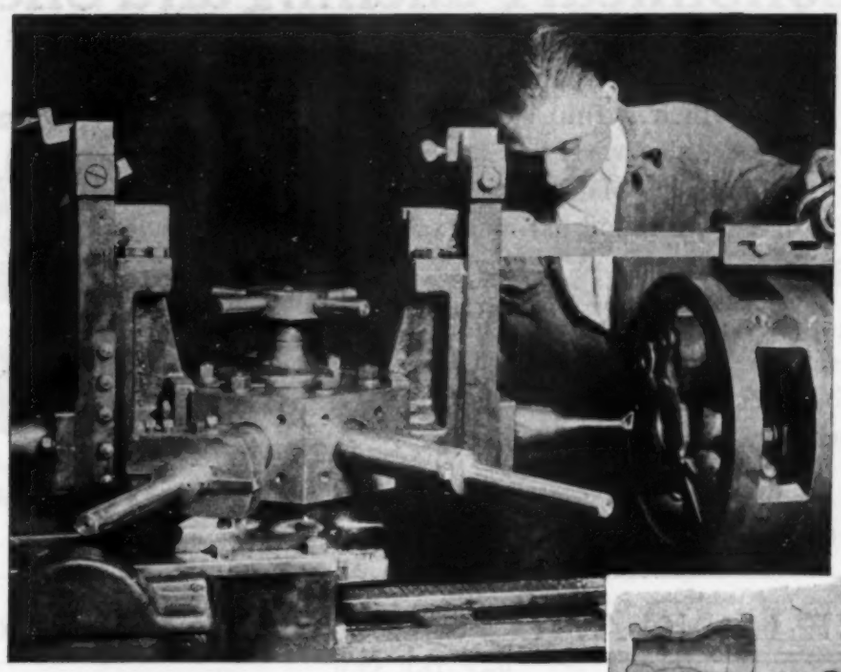
All styles are included in its repertoire—face, box, side or barrel.

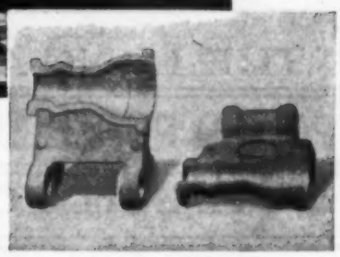
Rowbottom cut cams give an extra measure of value to your product. They aid in creating demand and thus increase profits.

If your work doesn't warrant the purchase of a machine, we can offer you a cam service without a parallel.

How about our literature?

The Rowbottom Machine Co.
Waterbury, Conn.
Factory at Waterville, Conn.





Turret Lathes in the Glass Industry

A production man from a large factory which has a reputation for its up to date production methods put the problem to us this way.

"We must reduce the cost of finishing these moulds for electric light bulbs. It is not customary to finish them on turret lathes, but we think *your* turret lathe can do the work as well and in less time."

(They have Warner & Swasey turret lathes in their shop doing other work.)

The turret lathes and tools we furnished do the work in one fifth the previous time. And their operator expects to do better than that when he becomes accustomed to the job.

You have jobs that should cost less. Send us blue prints of them. You'll be surprised at the saving we can show you.

The Warner & Swasey Company

Cleveland, U. S. A.

BRANCH SALES OFFICES:

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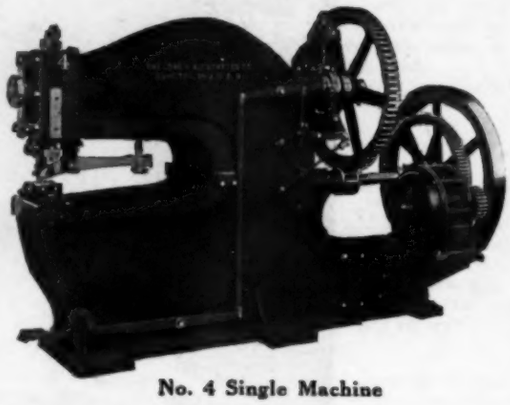
CHICAGO: 618-622 Washington Boulevard MILWAUKEE: 209 Sycamore Building
DAYTON: 518 Mutual Home Building INDIANAPOLIS: 940 Lemcke Annex

For Economical Punching and Shearing

This illustration shows an up-to-date machine with 36-inch throat which permits the handling of especially large sheets. It will punch ¾ in. hole through ¾ in. plate, and shear 4 by ¾ in. flat, or 1¼ in. round bar, or 3 x 3 x ¼ in. angles.

Our line comprises a practically unlimited choice of machines made in different sizes and styles to meet your exact needs for punching, shearing, hammering, etc.

Consult us for advice as to the machine best suited to meet your requirements.



No. 4 Single Machine

THE LONG AND ALLSTATTER CO.

POWER PUNCHING & SHEARING MACHINERY

AMERICAN PUNCH & SHEAR WORKS ... THE QUALITY LINE

HAMILTON, OHIO, U.S.A.

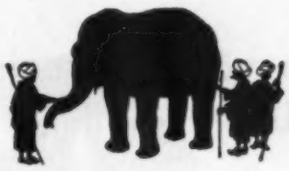
Bases Full

BARRETT TRIPLE PLAY ELECTRIFIER

For facing such work as water gates or valves, tees, elbows and the like, the Barrett Three-Way Facing Machine is designed to operate on three surfaces at the same time, thereby shortening the innings and making the game more interesting. Barrett performance doesn't depend on support at all. It will make a single put out, double or triple play any time you've tired of watching the other fellows play.

Ask for literature on this machine

Barrett Machine Tool Co., Inc.
Meadville, Pa., U. S. A.



A STORY handed down from Antiquity tells how three blind men were taken to "see" an elephant.

The first one grasped the swinging trunk and asserted that an elephant was like a snake.

The second put his arms around a huge rigid leg and said "how like a tree!"

Third blind man, running his hand along the broad, rough side of the animal said both were wrong, as an elephant was indisputably like a wall.

And then they wrangled.

The trouble was that they could not combine their knowledge.

Nor did they consult some one who could see the elephant in its entirety and give them the whole picture.

Today the need for exchanging ideas is met by Business and Trade Associations and Periodicals which cover almost every field of human and industrial activity.

Some little time ago there was no comprehensive Clearing House for the exchange of data on the Science of Lubrication.

Ten years ago, our magazine "Lubrication" was designed to meet that need.

And the large number of communications received and the actual service rendered have proved the worth of this idea.

But remember that there is a more immediate service and a more personal presentation of "the whole picture" in the daily work of Texaco Lubrication Engineers.

They are out in every field of industry covering every phase of lubrication as it applies to the production, transmission and utilization of Power.

Part of their work consists in making detailed reports. Hundreds are received daily. These reports are carefully digested and anything new or salient is transmitted to the whole force.

Thus, with our finger on the pulse of the industrial world, we are able to diagnose successfully every lubricating condition, and with the complete line of Texaco Lubricants at our disposal, we are ready to prescribe the right lubricant to take care of every mechanical condition.

For every power unit or machine, new or old, there is a Texaco Lubricant exactly suited to the work, and our Engineers know how to apply them in the right amount—no more, no less—to secure the most economical and efficient results.

On this basis we have built up an extensive, growing business in all classes of lubricants.

The plants, shops, mines and mills, who have benefited by Texaco Service cover the country and embrace every industry—yours included.

Call on us when you need lubricants, or Texaco Service.

There is a Texaco Lubricant for Every Purpose

Clip This Coupon

THE TEXAS COMPANY

PETROLEUM PRODUCTS

Dept. P1, 17 Battery Place, New York City

Offices in Principal Cities

Kindly put me on your free mailing list for "Lubrication."

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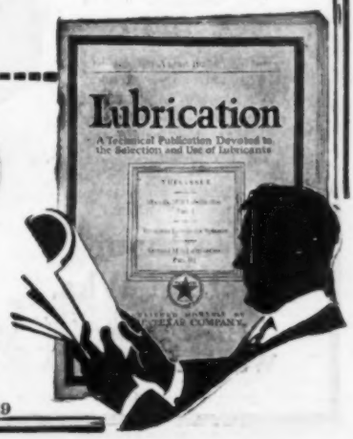
12-29



The Harder You Work Them

The greater do you appreciate their ability to produce economically.

Safety Grinding Wheels
and
Safety Grinding Machinery

Make a winning team anywhere

WIN WITH SAFETY

Tell us your grinding problem.
Our catalogues are Safety guide books. Have you yours?

THE SAFETY EMERY WHEEL CO.
2258 Columbus Avenue **Springfield, Ohio**

Waltham

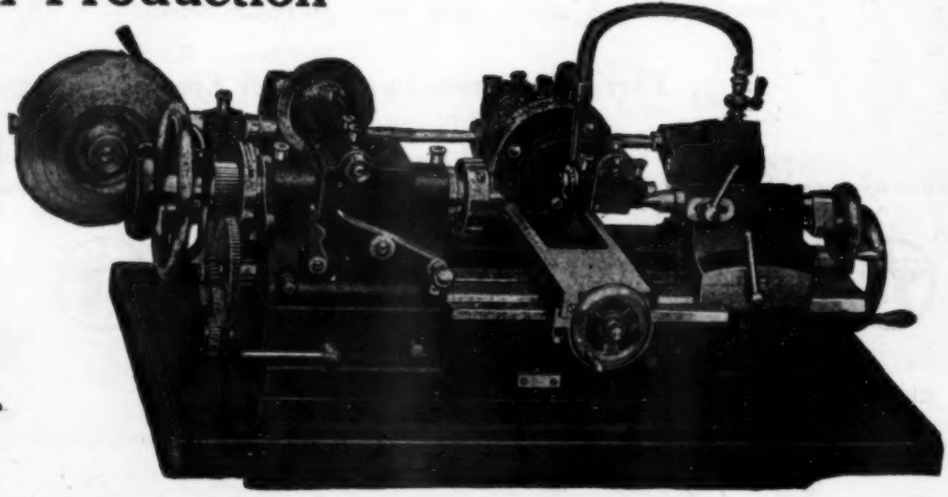
Thread Millers are Necessary to Your Production Plans

Up-to-date equipment alone will meet the 1922 manufacturing needs. On small threaded parts the **Waltham Thread Miller** will prove your chief ally.

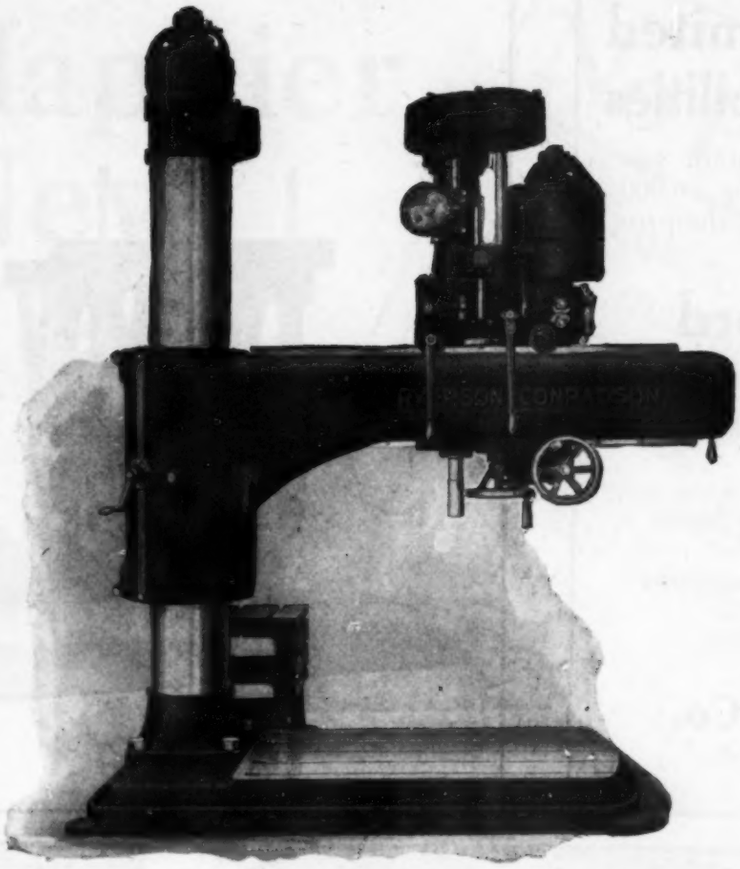
The accuracy and speed of this miller renders it, within its capacity, superior to larger machines. It will handle work 7¼ inches long by any diameter not over 3 inches.

When used on manufacturing work skilled workmen are not required. A multiple cutter may be used for some threads—a complete thread being produced in one revolution of the work.

The **Waltham** serves equally well in your tool room and manufacturing department. We will be pleased to receive samples or blueprints of your work for estimates on production.



Waltham Machine Wks.
High Street
Waltham, Mass.



Front End View, Showing Spindle on True Radial Line All Overhang of Head Eliminated.

Modern Tools for Modern Shops

Put the drilling part of your work up to a Ryerson-Conradson Radial.

When heavy work is needed the Ryerson-Conradson pulls at a high speed with a heavier feed than any like size machine. Direct motor drive and low machine friction is one reason, sturdier construction another. The wide speed and feed ranges give the right speed for any size drill you would use in a Radial.

Twice the area of the usual bearing surface plus no overhang of the arm insure accurate work.

Have a Ryerson-Conradson Radial in your shop when the load comes on again.

Bulletin 4001 fully describes other decided advantages. Have you received your copy?

JOSEPH T. RYERSON & SON

Established 1842 Incorporated 1888

CHICAGO ST. LOUIS DETROIT BUFFALO NEW YORK

RYERSON MACHINERY

Their Speed Gives Practically Unlimited Production Possibilities

Designed and built to maintain any spindle speed from 3,000 to 10,000 r.p.m. practically indefinitely, the production possibilities of

Leland-Gifford Sensitive Drilling Machines

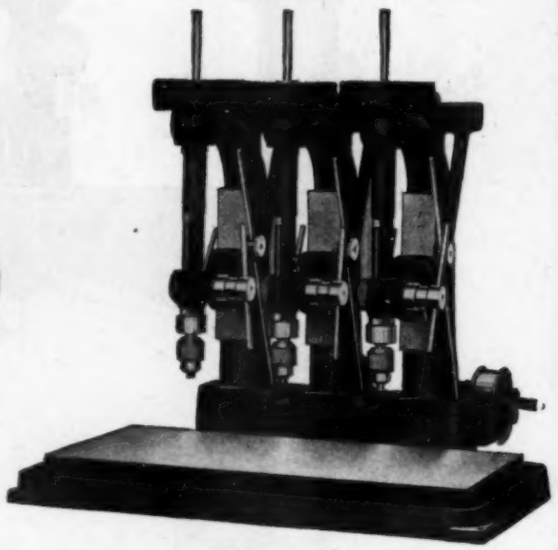
are limited only by the nature of the material and the speed of the operator.

They maintain their accuracy as long as they run. They represent more holes per dollar because of their continuous fast service.

Single and multiple spindles. Motor drive if desired

Write for complete details of these substantial sensitive drills.

Leland-Gifford Co.
Worcester, Mass., U. S. A.



B

Where e'er you find a "BUCKEYE" There you'll find GOOD HOLES!

For Buckeye Twist Drills are **uniformly** good. Our methods are thorough-going from metal-analysis to final inspection.

You can count on every drill making more holes per day, and standing up longer between grindings. And the last Buckeye hole, clean cut, is an exact duplicate of the first.

Buckeye Drills-Reamers

Why not put a Buckeye Drill to the test? We'll select the right one gladly.

The Buckeye Twist Drill Co.
Alliance, Ohio
Chicago Office: 26 S. Jefferson St.

A Happier New Year

October 13, 1921
Cut Production Costs—With Modern Equipment
No Profit Sale
To enable us to give unemployed machinists work we offer at replacement cost, without profit, our stocks of Lo-swing Lathes, Cylindrical Grinding Machines and Universal Grinding Machines.
Employment is urgently needed. We will give it with your help. Will you take advantage of this offer?
Fitchburg Machine Works
Lo-swing Lathes
Fitchburg Grinding Machine Co.
Cylindrical Grinding Machines
Universal Grinding Machine Co.
Bath Universal Grinding Machines
Fitchburg, Mass., U. S. A.

By taking advantage of the above offer you will make a move that will never be regretted. You get high-grade equipment at an unprecedented price and you give the mechanic the opportunity to earn his daily bread. Overflow the New Year measure of happiness by acting now.

Fitchburg Machine Works
Lo-swing Lathes

Fitchburg Grinding Machine Co.
Cylindrical Grinding Machines

Universal Grinding Machine Co.
Bath Universal Grinding Machines

Fitchburg, Mass., U. S. A.

The Hartness Screw Thread Comparator is a time saver in the shop

In the Assembly Room of many shops a lot of time is lost because threads are not just right and holes must be retapped so that screws will fit into them.

The Hartness Screw Thread Comparator saves all this wasted time because it insures no threads reaching the Assembly Floor that are not just right in all features.

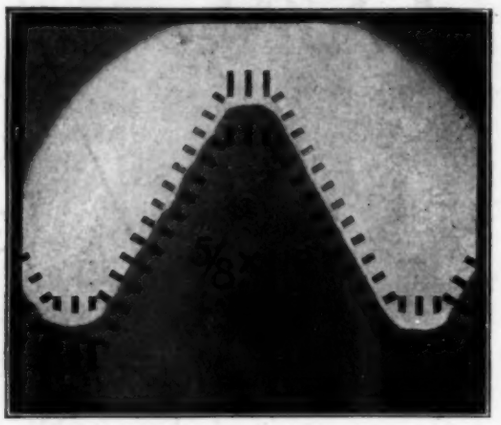
It makes the exact nature and location of thread troubles, instantly visible by throwing an enlarged shadow of the thread on a tolerance chart as shown, to the right, below.

It is a desirable *shop production tool* that does away with the blind method of inspecting screw threads by "feel."

When you can see your thread troubles they can be easily ended.

We invite correspondence on your thread troubles.

Jones & Lamson Machine Co.
COMPARATOR DEPARTMENT
Springfield, Vermont, U. S. A.



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That give the maximum service on your
GRINDING WHEELS
are carefully selected for all our tools.

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DIAMONDS, CARBON, BORTZ

DIAMOND TOOLS

hold their cutting edges for months. Can easily be sharpened and will last for years. Leave a smooth, true and finished surface. These special shaped carbon, black diamond, pointed tools are best for turning paper, cotton, corn husk, rag, fibre, hard rubber, etc. They turn out a large number of pieces of exact uniform size.

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Electric Industrial Trucks
Save Their Cost
IN FEW MONTHS
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The Elwell-Parker Electric Co.
Cleveland, Ohio

BALANCE

The construction of the Rockwood Handle insures perfect balancing—an important factor in machine design.

Rockwood Handles Cold Drawn from Strip Steel are made in eleven sizes. Samples and prices on request.

Rockwood Sprinkler Co. of Massachusetts
Worcester, Mass.

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Perfect Always

Twelve Medals Awarded at International Expositions

FOR SALE EVERYWHERE
Copy of Catalogue will be sent free to any interested file user on application

G. & H. BARNETT CO., PHILADELPHIA, PA.
Owned and Operated by the Nicholson File Co

INVESTIGATE THE LATEST

"WHITNEY"

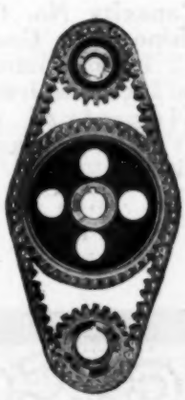
High Efficiency Roller and Silent Type

CHAINS

Low Cost per Thousand Miles of Service

Latest Roller Chains have special solid rolls and other important improvements

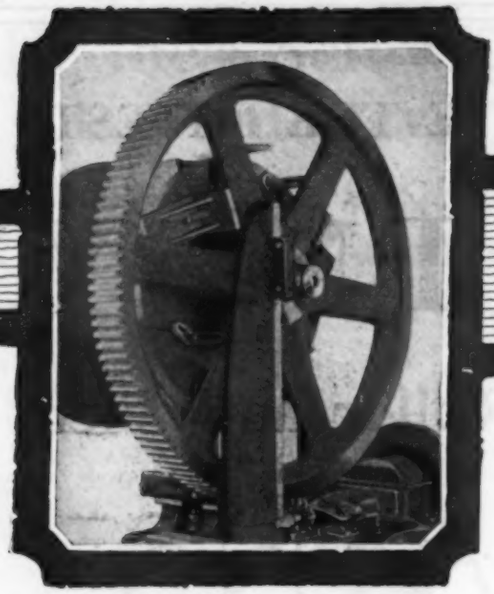
Front End Motor Chain Drives



EXCEPTIONAL MILEAGE

Never Known to Skip the Sprocket Teeth

THE WHITNEY MFG. CO.
Hartford, Conn., U. S. A.



BROWN & AUTOMATIC GEAR

For Cutting Gears with

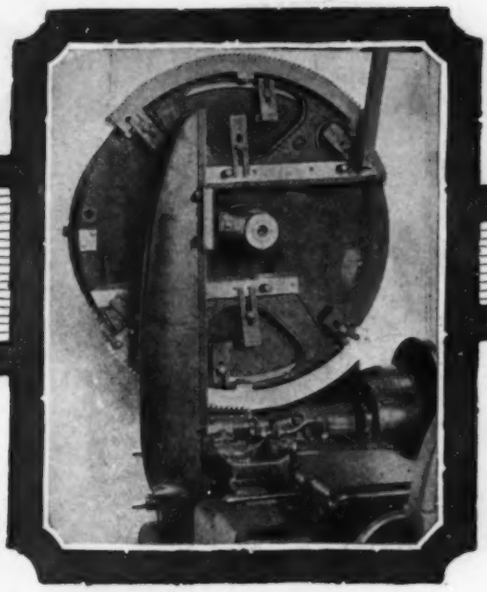
When specifications call for the cutting of large, heavy gears, as shown in the illustrations, the machine used must be one which will stand up under the strain of heavy work and produce accurate gears.

BROWN & SHARPE AUTOMATIC Gear Cutting Machines

possess both qualities. The driving belt and ratio of gearing are amply proportioned to the capacity of the machines. The cutter and work spindle are of exceptionally large diameter and the heavy balance wheel on the cutter spindle prevents chattering and maintains uniform cutting action.

Capacity No. 6 Machine Spur Gears to 72 in. diameter; 13 in. face, cast iron, 1¾ diametral pitch; steel, 2 diametral pitch.

BROWN & SHARPE MFG. CO.

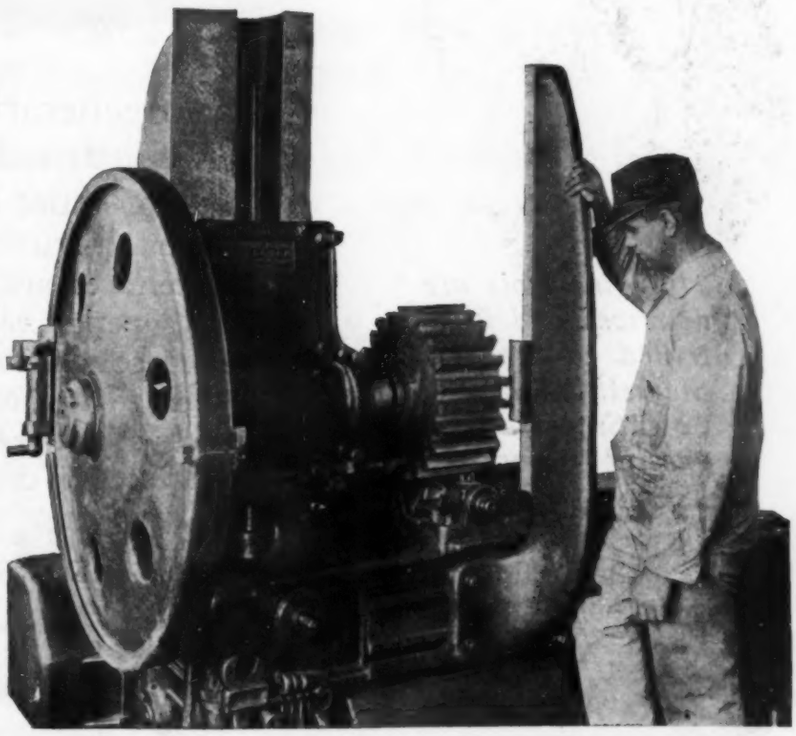


SHARPE
CUTTING MACHINES

Large, Heavy Accuracy

The accuracy with which these machines function is due primarily to their sturdy construction features. The substantial base and the one piece bed and upright, with heavy internal ribbing, furnish a rugged support and prevent vibrations that would impair the accuracy of the finished product. This rigid construction eliminates destructive chatter and permits utilizing fast feeds and high speeds.

The indexing mechanism starts and stops without shock and is locked positively for each tooth space. In addition, the index wheel is of large diameter and keyed to the work spindle, which further reduces the possibility of any inaccuracy in spacing.



Send for our General Catalog No. 137 listing our complete line of Gear Cutting Machines.

PROVIDENCE, R. I. U. S. A.

Two generations of skilled machinists have learned to know Starrett Tools and to trust them.

Under the tuition of these men, thousands of apprentices are today learning for themselves the superior value in every Starrett Tool. No more conclusive evidence of quality could be asked than the marked preference for Starrett Tools shown by these men, to whose livelihood the selection of good tools is an essential matter.

2100 fine tools are described and illustrated in the new Starrett Catalog No. 22"C." Sent free on request. Write for copy.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

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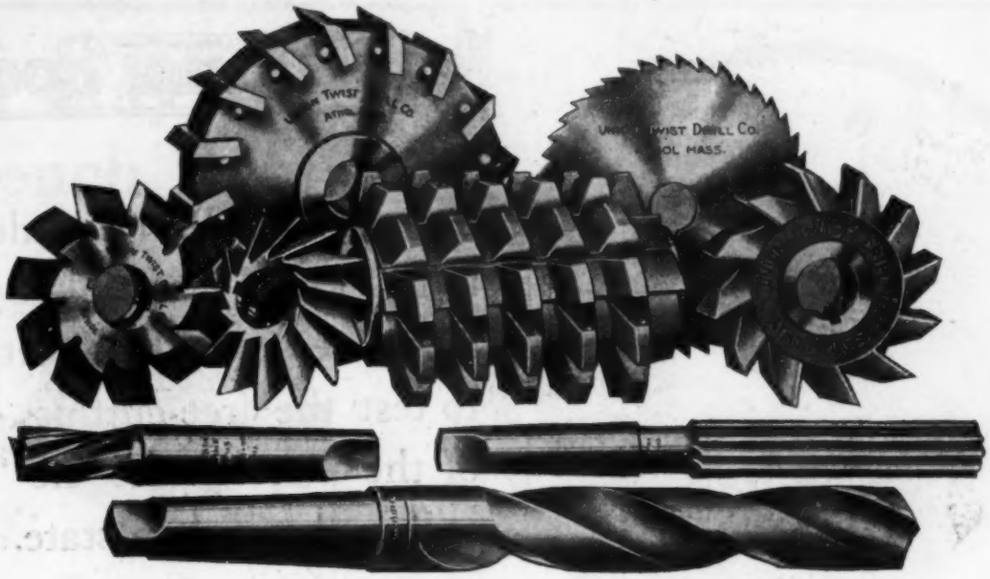
Starrett Tools



Industrial Conditions Clearly Suggest the Use of Union Tools

The necessity for cost-reduction is arousing tool users to the necessity for careful buying. Experience has shown that high grade tools are the most economical. Union Tools are KNOWN to belong to this class.

Are you still resisting this drift to Union? Perhaps you haven't realized before that there is a type for every purpose.

UNION TWIST DRILL CO.

DRILL AND CUTTER MAKERS

ATHOL MASS. USA

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Tools you buy again

Ledrite Brass Rod
A Bridgeport Product
It's Tested

Ledrite Brass Rod is made of carefully selected materials, by exclusive processes that make it possible to test the free-cutting qualities of the metal while the "heat" is still in the molten state.

Ledrite Brass Rod
A Bridgeport Product
It's Tested

Ledrite Brass Rod therefore offers the advantages of—
less tool wear, greater production and less rejections of finished parts.

Ask for Brass Rod Book No. 1432.

Bridgeport Brass Company
Bridgeport Connecticut

"Bridgeport"
TRADE MARK

Ledrite Brass Rod
A Bridgeport Product
It's Tested

Will Stay 'til the Bench Splits

THE positive lock on this **Athol Swivel Base** and **Swivel Jaw Vise** will hold it exactly where you wish it, under strains that will wreck your bench.

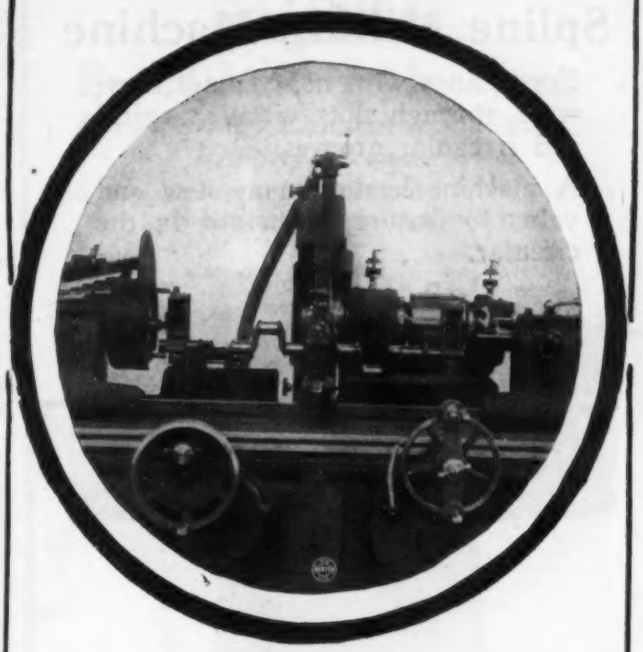
This is a mighty desirable type of vise for all-around bench use and readily accommodates itself to a wide variety of work.

The usual "holdfast" qualities are found in the jaws and speedy swiveling is a feature.

Send for Catalog No. 34 and note the full line of

Athol Vises

Athol Machine & Foundry Co.
Athol, Mass.



The Machine for the Automobile Repair Shop

The NORTON AUTOPART REGRINDING MACHINE need not stand idle in the automobile repair shop—it will do all the cylindrical grinding, the crankshaft, pistons, piston pins and valves. It is a convenient machine for any odd cylindrical grinding job. It was especially designed for the repair shop and is made to the same high standards as are the thousands of Norton machines in use in automobile factories.

This Autopart Regrinding Machine constitutes a large part of the equipment necessary for a regrinding shop.

Thousands of worn automobile engines are being renewed by regrinding.

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A 2-3

Spline Milling Machine

For splines with closed ends, keyways, through slots, circular, spiral and irregular grooves.

A machine having many new and valuable features described in the circular.

Let us send you a copy.

The Taylor & Fenn Company
Hartford, Conn., U. S. A.

KNIGHT

Milling and Drilling Machine

This is one of the most versatile machines of its kind on the market. It will handle a larger variety of general shop and toolroom work than any other single machine, to our knowledge.

The Table Tilts

The table of the Knight can be swung to practically any angle in the entire circle, and work can be milled, drilled, reamed, bored, etc., at the same setting.

It is exceptionally simple of construction and operation. Any intelligent man or boy can easily be taught to run it, and turn out the best grade of work.

Economical Maintenance

All parts of the Knight are interchangeable. There is nothing superfluous or over-elaborate. Its power consumption, operating costs, and initial investments are nominal. Literature on request.

W. B. Knight Machinery Company
3920 West Pine Boulevard, St. Louis, Mo.

Better Keyseats for Less Money on the

GIANT

The design of the GIANT Keyseating Machine assures precision. Set-Ups are a matter of seconds as no clamps are required to hold the work to the table. The "pull down" of the cutter bar prevents slipping and chatter. Speed is a big factor.

Your work will not prove difficult for the GIANT.

Let us show you.

MITTS & MERRILL, Saginaw, Mich.

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12-14-16-Single Geared
16-20-Back Geared
26-in. Combined Open Side Crank Planer and Shaper
Bulletins on Request

The Whipp Machine Tool Co.
Sidney, Ohio, U. S. A.

Woodward & Powell Planers

Builders of High Grade Planers for 33 years. Accurate to the highest degree and Rugged to stand up to the hardest work.

Woodward & Powell Planer Co.
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BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

THE NATIONAL MACHINERY CO. TIFFIN OHIO U.S.A.

Increased Production Thru

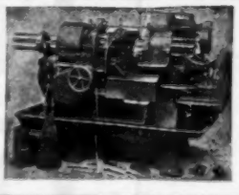
Hardened and Ground Journals with Ring Oiling Removable Bushings. Semi Steel Castings. Hyatt Roller Bearings in C/S. All Helical Driving Gears Superior Table Support. Quick change feed, etc.

Queen City Machine Tool Co.
(Sta. V.)
Cincinnati, Ohio, U. S. A.

CINCINNATI 5-Spindle AUTOMATIC Screw Machine

No Special Cams Needed. Uniform feed. For jobbing as well as long runs.

Cincinnati Automatic Machine Co.
Cincinnati, U. S. A.



P&H

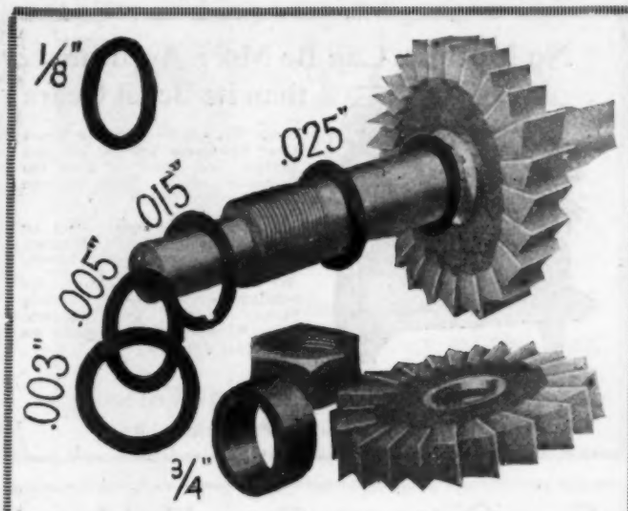
Boring, Drilling and Milling Machines

Pawling & Harnischfeger Company
Milwaukee, Wisconsin

WE are manufacturers of Lincoln Type Milling Machines, Bench Milling Machines, Hand Milling Machines, and a line of reliable Screw and Lever Vises.

Get our circulars and prices.

THE CARTER & HAKES MACHINE CO.
Winsted, Conn., U. S. A.



Spacers for Milling Machines Arbors, etc.

For arbors of the following diameters, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 1¾ 1⅞, 2, 2¼, 2½ and 3½ inches.
.003, .005, .015 and .025 inch thicknesses in stock.
.0015 to 3.000 inch thicknesses made to order.

Prices and Samples on Request.

Detroit Stamping Company
3445-3459 West Fort Street, Detroit, Mich.

BURKE

Bench Milling Machines

For Accuracy, Convenience, Power, Rigidity, Economy

And the ability to handle any work within the range of the machine.

Machines are built in 5 sizes with either hand or power feed, with or without overhanging arm, bench or column type, and may be fitted with complete set of attachments.

Catalogue gives complete description of machines and attachments. Also Burke Drill Presses and Tapping Machines.

Cut shows the No. 4 Bench Type Machine, Price $220, with Column $236.

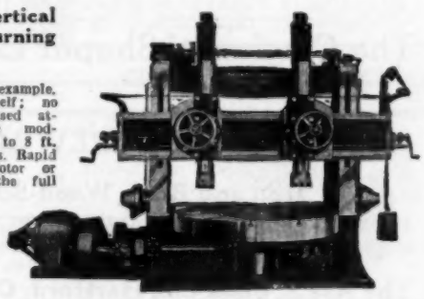
The Burke Machine Tool Co.
520 Sandusky St., Conneaut, Ohio, U. S. A.
Dealers in all foreign countries—Write for addresses

Vertical Boring and Turning Mills

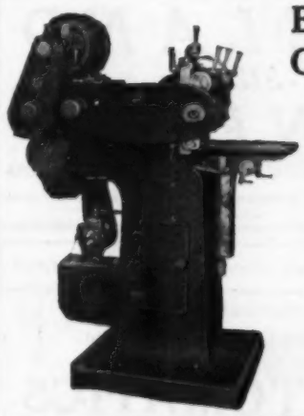
handle a wide variety of work not expedient or possible on other machines—particularly the unusual, the irregular.

BICKFORD Vertical Boring and Turning Mill

is a finely developed example. Complete within itself; no costly and seldom-used attachments, therefore moderately priced. 4 ft. to 8 ft. Single or double heads. Rapid power traverse. Motor or belt driven. Get the full catalog description.



H. Bickford & Co.
Lakeport, N. H. U.S.A.



Economical Output Is the Cry

The Standard Milling Machine will handle your small and medium Slotting, Slabbing, Straddle Milling, Profiling, Cam Cutting, Hobbing and Spline Milling operations in a highly economical manner.

It performs many of the operations you ordinarily put on the large, expensive machines.

Get the Bulletin and note its range.

The Standard Engineering Works
Pawtucket, R. I., U. S. A.

Enlarge Your Working Capacity the "Davenport" Way

The wide range of screw machine jobs and the large output made possible on the Davenport Multiple Spindle Automatic Screw Machine, enlarges the working capacity of any shop having this kind of work to do.

There's no sacrifice in accuracy or finish to get the "Davenport" output.

Many users say that they have taken on business which could never be touched under old production costs.

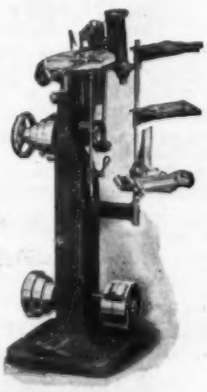
Let us send you our Catalog. Now

Davenport Machine Tool Co., Rochester, N. Y.

THE AUTOMATIC MACHINE COMPANY
Bridgeport, Conn.

Makers of

Automatic Threading Lathes
Automatic Hob Thread Millers
Coulter Multiple Spindle Profilers
Coulter Shaping Planers Special Machine Tools



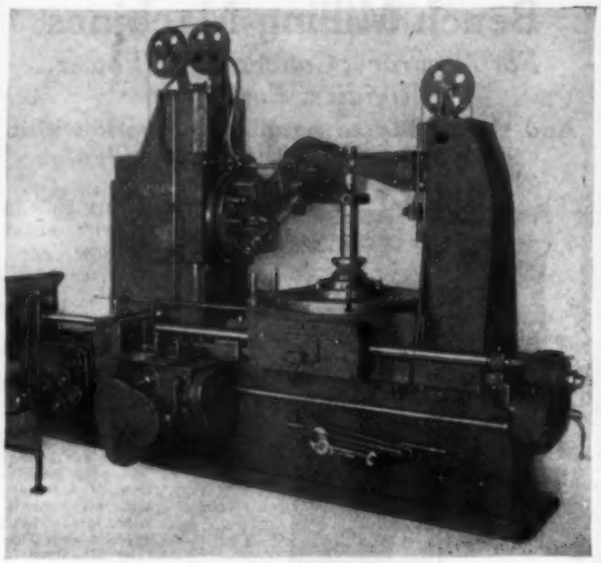
Cochrane-Bly Filing Machines

Floor and Bench
Belt and Motor Drive

Send for Circulars.

Cochrane-Bly Co.
Rochester, N. Y.

NEWARK GEAR



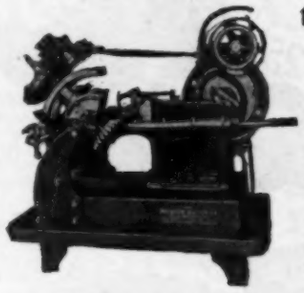
Newark Hobbing Machine

The growing use of herringbone-gears demands that they be cut on the proper machine.

The NEWARK Hobbing Machine is designed just for such work as herringbone and helical gears. It saves time in setting up and in cutting; and time represents money. The gears are cut with the greatest accuracy.

Newark Gear Cutting Machine Co.
Henry E. Eberhardt, President
65 Prospect St., Newark, N. J.

No Machine Can Be More Accurate than its Bevel Gears



Gears cut on the **Bilgram Bevel Gear Generator** prevent all lost motion and thus enhance the precision of machines of the better grade.

Whether you cut your own or we cut them for you, **Bilgram Gears** will prove more efficient.

We have special facilities for cutting Spur, Worm, Helical, Miter, Internal and Elliptical Gear Wheels. Let us quote on the gears you use.

The Bilgram Machine Works
1233 Spring Garden St., Philadelphia, Pa.

Gear Cutters—Gear Hobbers

For Spur and Spiral Gears

A complete line of automatic machines for automotive and industrial requirements.

The Cincinnati Gear Cutting Machine Co.
(Subsidiary of The Cincinnati Shaper Co.) Cincinnati, Ohio

FOR RAPID AND ECONOMICAL PRODUCTION OF ACCURATE GEARS—INSTALL A

Farwell Gear Hobber

Write for Catalog No. 809

THE ADAMS COMPANY
1910 Bridge Street Dubuque, Iowa, U. S. A.

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—OPEN-SIDE—
PLANERS

THE CLEVELAND PLANER COMPANY, CLEVELAND, OHIO

CINCINNATI SHAPERS

Strokes from 16 to 32 inches

Also Crank Planers and Traverse Head Shapers

The Cincinnati Shaper Co., Cincinnati, Ohio

For screw machine economy, accuracy and big output

4 Sizes—Get Catalog

Cone Automatic Machine Co., Windsor, Vermont
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COOK'S WOOD-SCREW MACHINES

for making

Iron and Brass Wood-Screws

EASY TO OPERATE RAPID OUTPUT ALL SIZES

Modern plant equipment furnished for starting Wood-Screw factories

SEND FOR CATALOG G-H

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A New Way to Mill Threads

Hall Planetary Thread Millers

Reduces threading cost 50% on some classes of work. Cuts all style threads internal or external.

Write for particulars.

THE HALL PLANETARY THREAD MILLING MACHINE CO.,
Bridesburg, Philadelphia, Pa.

High Duty Shapers and Automatic Gear Cutting Machinery

GOULD & EBERHARDT
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1853 NEWARK, N.J. U.S.A. CHANCELLOR AVE.

Morton 36-Inch Draw Cut Shaper

A somewhat wider range can be covered, and a heavier grade of work can be done on this machine than on our 30-in. stroke model.

The main difference lies in the fact that the cross-rail is adjusted by two screws instead of one. Also, it can be furnished with extended crossrail and larger table, which adapts the machine to work of a larger size.

We will gladly discuss the applicability of this machine to any work you may have.

Ask for Bulletin No. C-3.

Morton Mfg. Co., Muskegon Heights, Mich.

KELLY SHAPERS

Have the advantage of being the sole machine tool product of an organization of specialists. They possess correct design, unusual accuracy and are easy to operate. Three sizes, single geared; four sizes, back geared. **Write for a Catalog.**

THE R. A. KELLY COMPANY Makers of shapers only for 25 years.
P. O. BOX 488 XENIA, OHIO, U. S. A.

TIREX
(ALL RUBBER)
Portable Cord

Tirex Cords are extremely flexible. They may be bent, twisted and tied in knots repeatedly without damage. It is impossible to kink them and they always lie flat on the floor leaving no dangerous loops to trip over. Because they never kink their maximum length is always available without delay or annoyance.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
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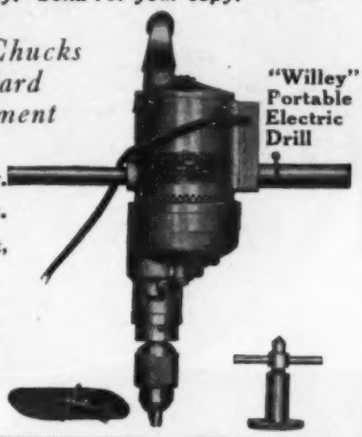
You don't have to favor the "Willey"

Portable drill demands are usually severe and it takes a rugged machine to stand up to day-in-day-out service.

Mechanically correct design and smooth, powerful, action gives long service life to "Willey" Portable Electric Drills. They are designed and built for *Service* and prove efficient under all working conditions. "Willeys" have stood the test for over 25 years and will prove economical in your shop.

The Catalog gives details that prove "Willey" superiority. Send for your copy.

Jacobs Chucks Standard Equipment



"Willey" Portable Electric Drill

James Clark, Jr. Electric Co., Inc.
521 W. Main Street, Louisville, Ky.

Foreign Representatives: Buck & Hickman, Ltd., London, Eng.; Bevans & Edwards, Melbourne, Australia; Alfred Herbert, Ltd., Yokohama, Japan.

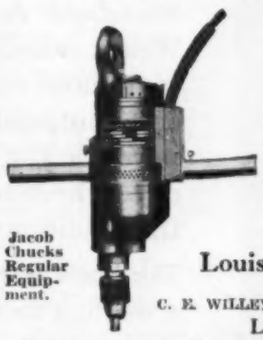
Reliance Electric & Engineering Co., 1044 Ivanhoe Rd., Cleveland, O.

STANDARD PORTABLE ELECTRIC DRILLS AND GRINDERS

Manufactured in all sizes for both A. C. and D.C. Every tool guaranteed for one year, both electrically and mechanically. Write for Catalog and Price List.

The Standard Electric Tool Co.
Cincinnati, Ohio

New Single Speed Pioneer Electric Drill



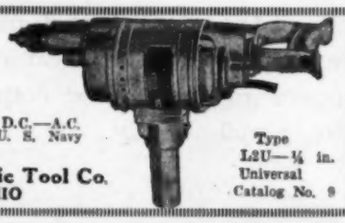
Jacob Chucks Regular Equipment.

"It Will Do the Work"

The Pioneer line of high grade Electrical tools is complete. A size and style for every purpose. Write for prices and description.

Louisville Electric Mfg. Co.
Incorporated
C. E. WILLEY, Pres. J. B. McFERRAN, Sec'y-Treas.
Louisville, Ky., U. S. A.
New York Representative: 150 Nassau St., New York City.

Portable Electric Drills and Grinders

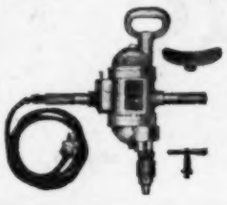


Complete line of sizes suitable for D.C.—A.C. and Universal current tested to U. S. Navy requirements.

Type L2U—¼ in. Universal Catalog No. 9

The Neil & Smith Electric Tool Co.
CINCINNATI, OHIO

BURKE ELECTRIC CO.
ERIE, PA.
A.C. D.C. MOTORS A.C. D.C. GENERATORS
MOTOR GENERATORS, ARC WELDING EQUIPMENT
Sales Offices: Buffalo, Cleveland, Detroit, Erie, New York, Philadelphia, Pittsburgh
Sales Agencies: Underwood Electric Co., Cincinnati; W. T. Osborn, Kansas City



Expensive Equipment Is Not Always Necessary

Take U. S. Electric Tools to the work and save four-fifths of the time usually required on each job. Every kind of portable drill, grinder and buffer ready for prompt delivery. Write for Catalog.

THE UNITED STATES ELECTRICAL TOOL CO., Cincinnati, Ohio

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Detroit Office, Marquette Bldg.
Pittsburgh Office, 2138 Oliver Bldg.
Houston Office, 308 Lumbermen's Bank Bldg.
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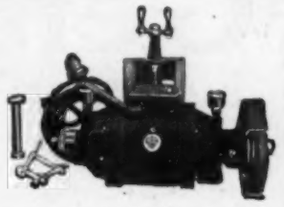
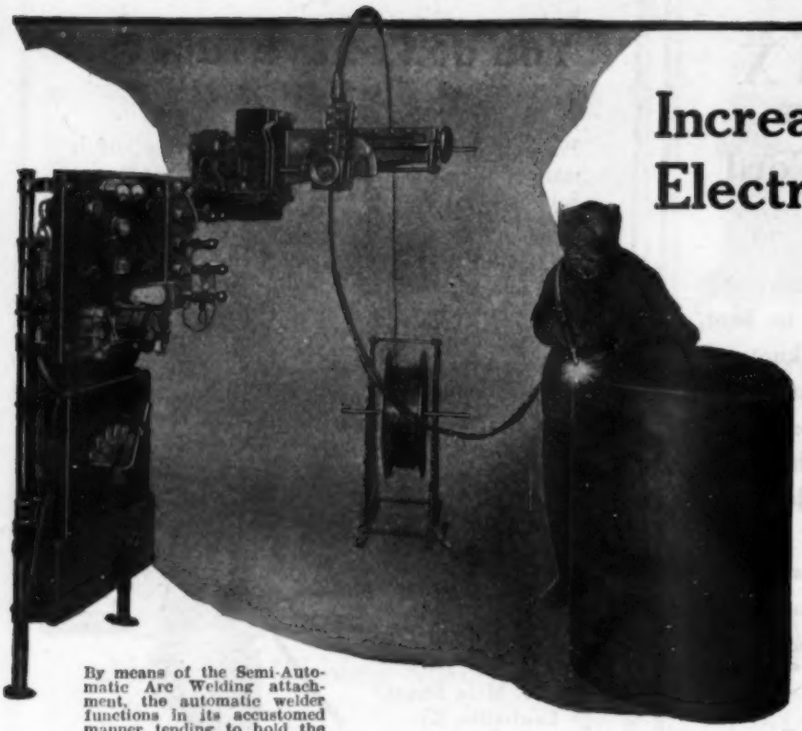
Milwaukee Office, 915 Majestic Bldg.





By means of the Semi-Automatic Arc Welding attachment, the automatic welder functions in its accustomed manner tending to hold the arc length constant, and the operator merely directs the arc as required by the particular job.

Increase Your Use of Electric Arc Welding

Advantages

Saves time ordinarily lost in changing electrodes.

Saves 10% to 25% in electrode material ordinarily thrown away as waste ends.

Operators learn to use it quickly, as they do not require the muscular training for hand welding.

Continuous operation results in few interruptions in the welding, eliminating a source of defective welds.

This new G-E device can be attached to any G-E Automatic Arc Welding head in such a manner that the electrode wire passes from the feed rolls into the flexible tubing and thence to the arc through a guide nozzle in the welding tool.

Automatic electrode feed—hand work

The G-E Semi-Automatic Arc Welding Lead is a device to be attached to the G-E Standard Automatic Arc Welder which obtains the continuous welding features of the automatic welder, and permits the operator to direct the arc as required by the conditions of the work.

This new device consists of a welding tool to be held by the operator, which acts as a guide for the electrode wire. In the handle of the welding tool there is provided a switch for operating the control on the panel of the Automatic Welder. Attached to the welding tool is a 10-ft. length of flexible steel tubing (called the flexible wire guide) with an adapter at the other end for attaching it to the automatic welding lead.

By means of this attachment the operator can work on products where the seam to be welded is of very irregular contour, or on large work where the clamping and travel mechanism for full automatic welding would be complicated and costly.

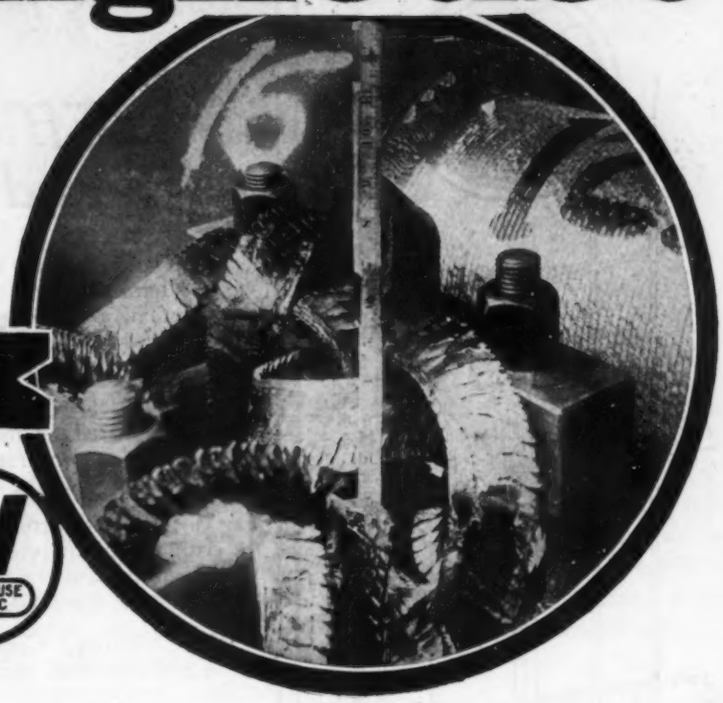
General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

43B-630

Westinghouse



Illustrations of the Houston, Stanwood & Gamble lathe on which a Westinghouse 35 horsepower motor successfully operated at 80 horse power.

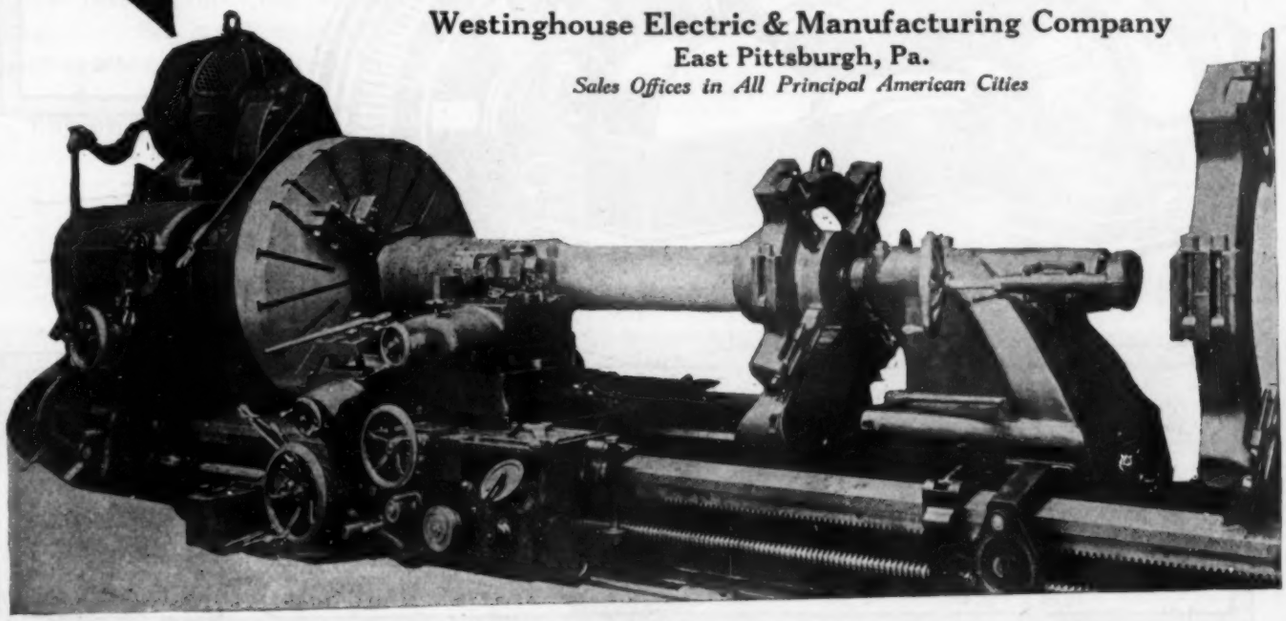
Back of the Tool—POWER

In a test run to determine the power of a lathe and its component parts, a Westinghouse 35 horsepower motor successfully operated at 80 horsepower. An extract from an official report of the test read:

"The chips which we sent you represent a 3¾-in. reduction in diameter at 15 feet per minute at ¼-in. feed, which shows that we took a 1⅞-in. depth of cut. The ampere reading during this time registered from 250 to 275 and at 220 volts indicates that we were using about 75 or 80 electrical horsepower. After running this test for 10 to 15 revolutions of the forging, we decided to stop and take a photograph of the actual chip coming from the tool, although the lathe gave no evidence that it could not continue on this cut for hours."

This test proved that the Westinghouse motor as "the power back of the tool" was fully capable of meeting exceptional requirements.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.
Sales Offices in All Principal American Cities



Air Compressors

Efficiency at Full and Partial Loads

The volume of air required will vary with your production and it is hardly possible to predict what this will be at all times. The question, therefore, comes down to the installation of an air compressor which not only meets your maximum requirements, but also operates efficiently at partial loads.

Class "PRE" direct-connected electric motor driven compressors are regulated by the 5-step Clearance Control which causes the compressor to operate at any one of the *five different load points*, depending upon the demand for air.

With this Control, the Class "PRE" Compressor will deliver **full, three-quarter, one-half, one quarter, or none of its capacity,** and the horsepower required will be practically in proportion to the air output.

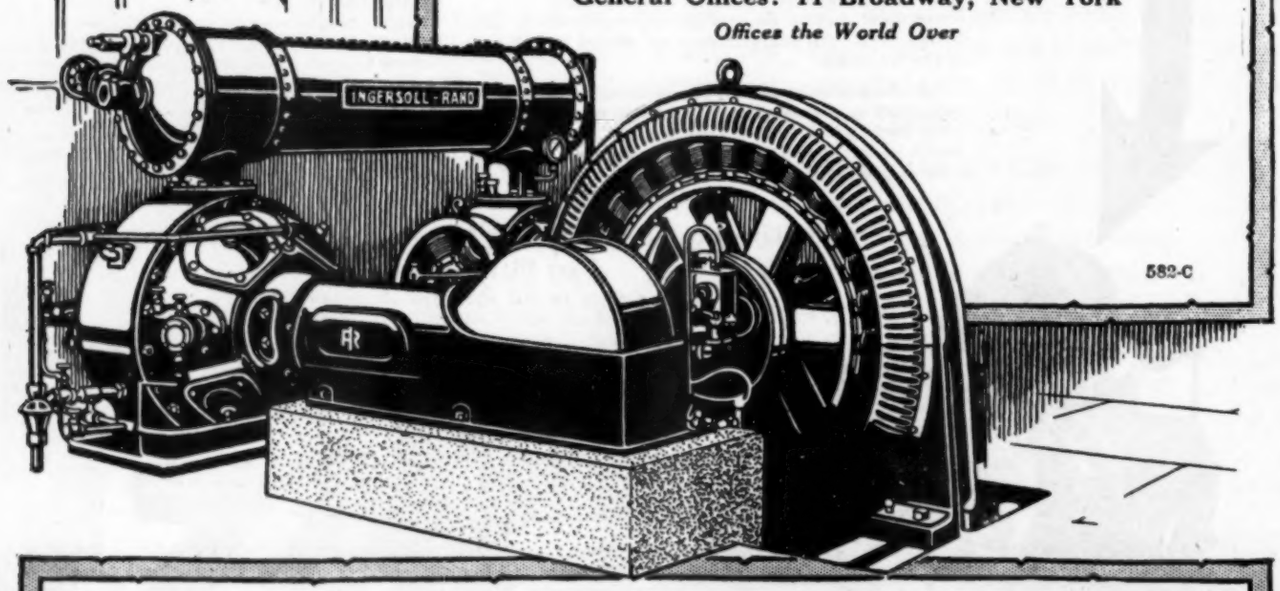
The Clearance Control is entirely automatic being governed by a predetermined variation in air receiver pressure.

We will be glad to tell you more about Class "PRE" Compressors. Meanwhile request Bulletin 3126, which describes these machines in detail.

INGERSOLL-RAND COMPANY

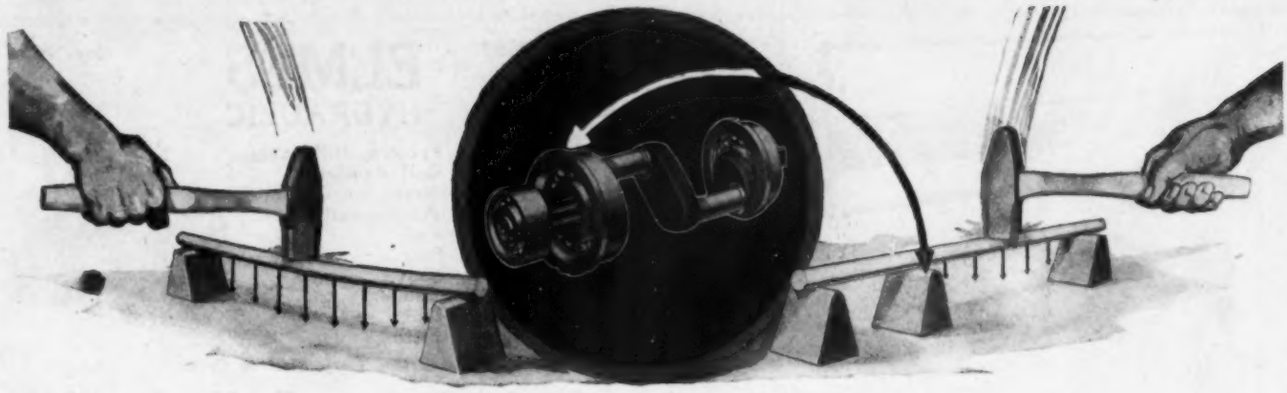
General Offices: 11 Broadway, New York

Offices the World Over



582-C

Ingersoll-Rand



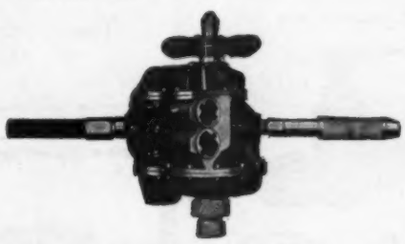
Permanent crankshaft alignment has a vital relation to economical air drill operation

WHEN a hundred-odd pounds of air pressure shoots against the pistons of an air drill, the crankshaft which shoulders the load must be properly aligned and rigidly supported, or every moving part is subjected to unusual strains.

Such support is not only desirable but necessary in permanently securing proper crankshaft alignment, which is possible only by placing supports on *both* sides of the main driving gear. If either the outer or inner bearing is omitted at the driving end, improper crankshaft alignment often results, throwing severe strains on the crank pins, connecting rods and crankshaft.

Connecting rods out of alignment cause undue wear on the cylinders and pistons. Crankshafts out of alignment, result in excessive wear on the gears, probable teeth breakage, reduced drilling power and increased friction with resultant increased air power costs.

With the three-point ball-bearing crankshaft suspension, exclusively embodied in Little Giant Air Drills, crankshaft alignment is *maintained*. Air drill designers can eliminate this extra *third* bearing, but they cannot eliminate its *job!*



Little Giant No. 4 Air Drill
One member of a complete line embracing over sixty sizes and types

Three-point crankshaft suspension is but *one* of the distinctive features of Little Giant Air Drills. Balanced piston valves which resist wear and remain leak-proof indefinitely, and three-unit housing construction which lessens upkeep expenses and provides easy accessibility, are other advanced features making Little Giants the most *economical*, most *productive* air drills built. Prompt deliveries from Branch stocks. Ask for Bulletin 598.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building · 6 East 44th Street · New York

*Sales and *Service Branches all over the World*

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P-95

BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS,
GIANT OIL AND GAS ENGINES · ROCK DRILLS · COAL DRILLS

LITTLE *The World's Standard* **GIANT** *Air Drill*

How Can It Serve You?

The Oilgear Hydraulic Control Pump driving a double-acting piston rod is something entirely new. It will do a hundred jobs for which nothing else is adapted. It gives a nicety of control of a ram movement unattainable by any other means.

A 4-in. piston can be moved at speeds varying smoothly from ½ in. per minute up to 30 in. per minute in either direction, holding speed against any resistance up to 8500 lb. Rapid traverse of 200 in. per minute in either direction against any resistance up to 2000 lb. Machine is protected against overload, and ram may be run against rigid stops. All movements of the ram, fast or slow, and in either direction, are controlled by the handle on top of the Control Pump. It is driven from any lineshaft. Working parts few and simple, perfectly lubricated, and run indefinitely without wear.

The outfit is applicable wherever a slow, powerful ram movement with accurately variable speed control and rapid traverse are desired. The extraordinary success achieved feeding carriages of machine tools has led to its uses on hydraulic mandrel, straightening, assembling and broaching presses; for opening heavy gate valves and lifting heavy masses under absolute control; for pushing cars in tunnel kilns, etc.

Send for bulletins describing the OILGEAR Control pump and Cylinders, 20-ton Hydraulic Press, 10-hp. Variable Speed Drive.

OILGEAR

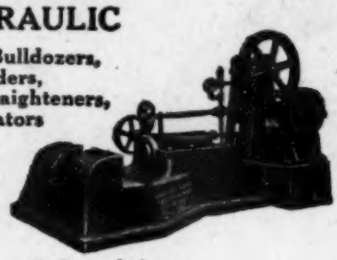
THE OILGEAR COMPANY, Milwaukee, Wisconsin

Manufacturers of Variable Speed Hydraulic Power Transmission Machinery.

Est. 1861 *Inc. 1895*

ELMES
HYDRAULIC

Presses, Bulldozers, Rail Benders, Shaft Straighteners, Accumulators and Pumps, Valve Gauges and Fittings



Machinery Built to Order

Charles F. Elmes Engineering Works
1001-1013 Fulton St., Chicago, U. S. A.

Do you want to mold it of Bakelite, Condensite, Casein or any of the Shellac or Rubber compounds?

Then Ask Us—we are prepared to estimate upon and to supply the entire moulding plant or any part of it, presses, molds, etc.

BURROUGHS
COMPOSITION MACHINERY CORPORATION
NEWARK, N. J., U. S. A.

HYDRAULIC VALVES AND FITTINGS

Watson-Stillman valves are designed to perform their functions with ease and safety. The materials are the best obtainable, and each valve or fitting is tested to a safe overload.

Our line embraces an almost endless number of combinations designed to meet the varied requirements of hydraulic systems.

Write for Catalogs

W-S HYDRAULIC

The Watson-Stillman Co.
42 Church Street, NEW YORK
McCormick Bldg., Chicago

W-S HYDRAULIC

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HYDRAULIC MACHINERY

Tell us what Hydraulic Equipment you need. Presses, Pumps, Valves, Accumulators. We will submit catalogs, drawings and estimates.

HPM
FOR YOUR PRESSING NEEDS

The Hydraulic Press Mfg. Co.
Mount Gilead, Ohio
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AIR COMPRESSORS-HOISTS-TROLLEYS-CRANES
ST. LOUIS

Curtis Pneumatic Machinery Co.

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1629 Kienlen Ave.
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Cut your grinding costs, and increase production. Use a

PANGBORN SAND-BLAST

PANGBORN CORPORATION ALL-WAYS SERVICE AND ALWAYS HAGERSTOWN, MD.

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Ultimately a Bury Universal Variable Volume, 3-Cylinder, 2-Stage Air Compressor. Why not install one now?

Durable as the Pyramids
All Sizes
All Types
All Pressures
For All Requirements

Silent as the Sphinx

Bury Compressor Co., 1800-1900 Cascade St., Erie, Pa., U.S.A.

A Portable Electric Grinder

with windings that cannot be burned out. They are insulated with asbestos with special silicate treatment.

Write for particulars

Forbes & Myers, 170 Union St., Worcester, Mass.

Think now—
Why did these concerns install
SELLS *Roller Bearings*

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Aunt Jemima Mills Company
French, Shriner & Urner
United Shoe Machinery Co.
Gillette Safety Razor Co.
American Agricultural Chemical Co.
(25 plants)
Newberry Cotton Mills
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Dodge Brothers
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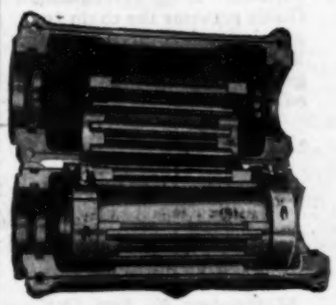
And there are thousands of others.

They— Fit your present hanger frames.
Can be installed overnight.
Are split throughout.
Save at least 10% of your power—more often 20%



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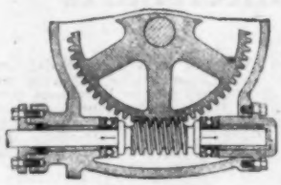
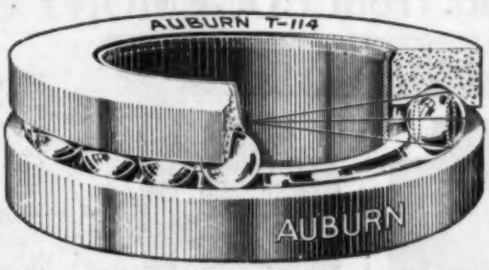


Fig. 1.



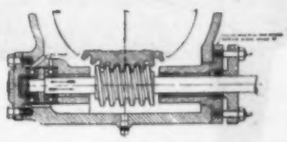


Fig. 4.

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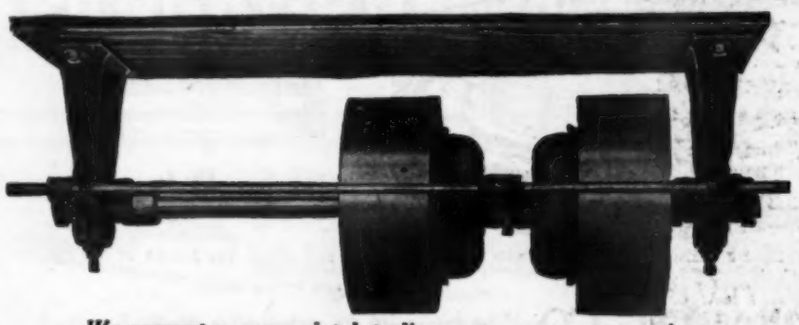

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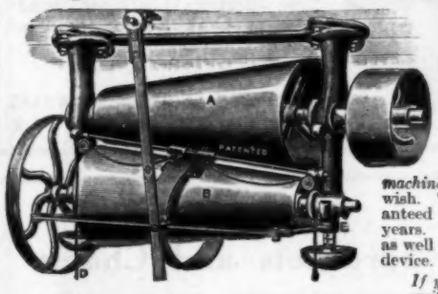

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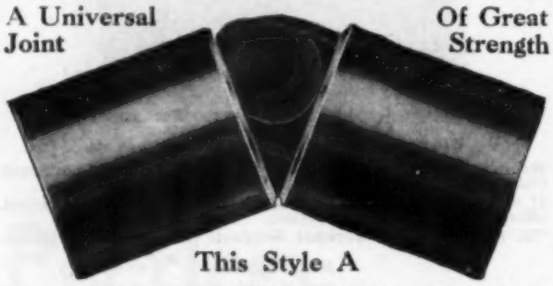

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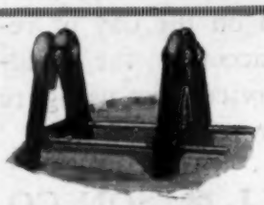

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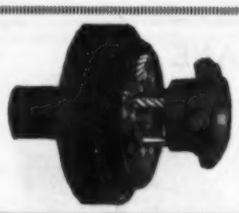

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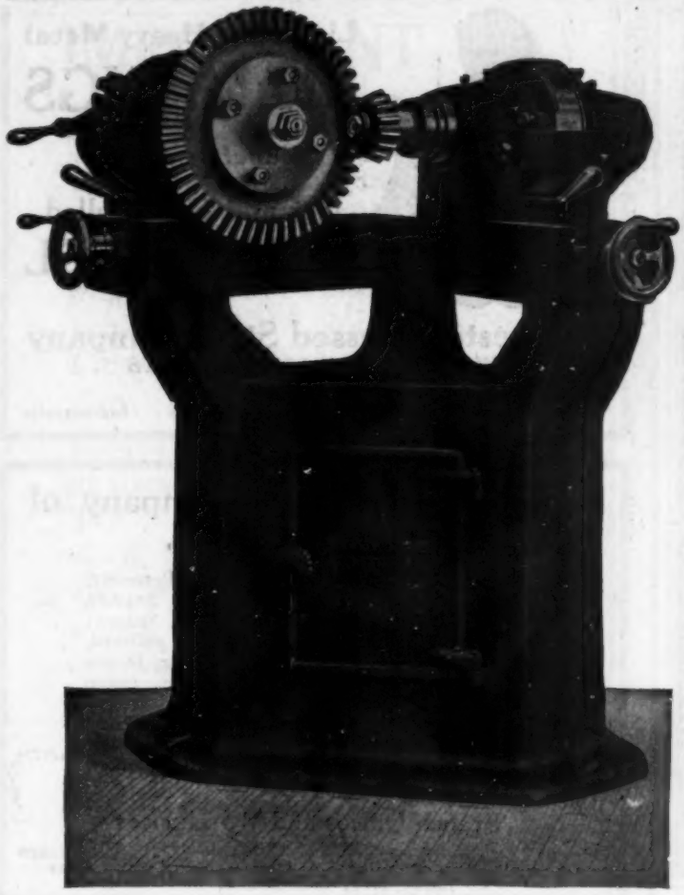

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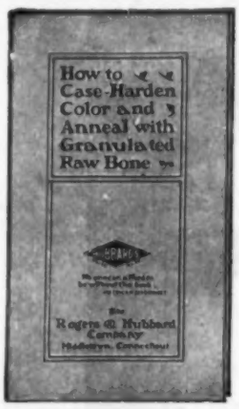

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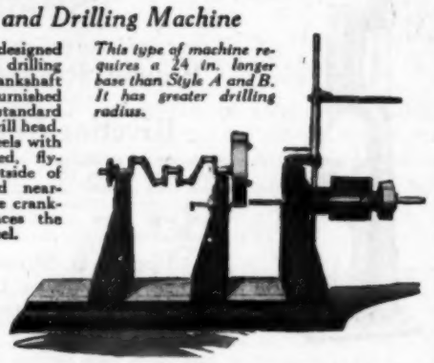

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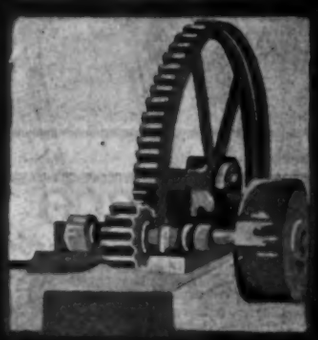

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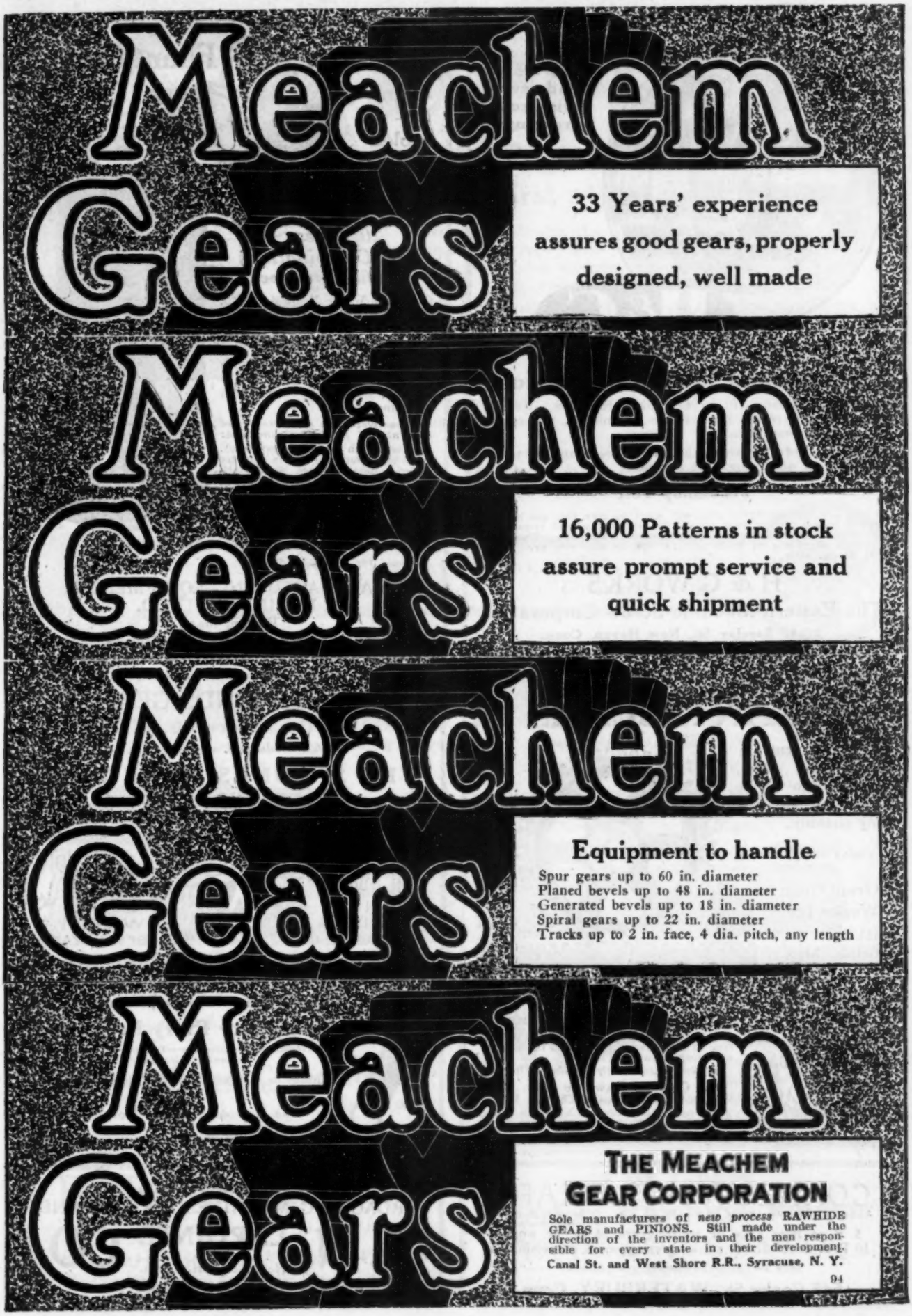
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16,000 Patterns in stock assure prompt service and quick shipment
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Sole manufacturers of *new process* RAWHIDE GEARS and PINIONS. Still made under the direction of the inventors and the men responsible for every state in their development.
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This die head revolutionized threading

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H & G Die Heads will increase your production, give you better threads, reduce rejections to a minimum, and enable you to meet competition.

They are made in three principal styles, adaptable to all machines on which threading is done.

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Fig. 627

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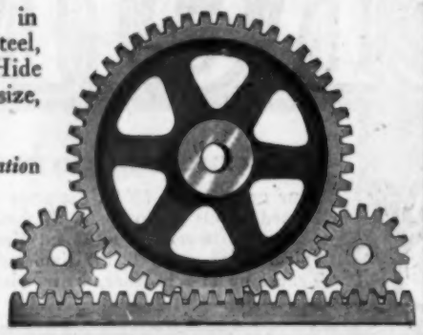

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They are accurately cut.

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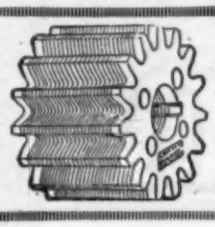

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5 P or finer spur or worm gears 36 in. or smaller
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Type M-7 on Truck

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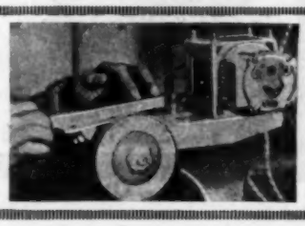

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Can Grind a Drill to Perfection in Thirty Seconds

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These are performances on the "SANFORD CENTERLESS."

FASTEST SPEED—Piston Pins ⅞ in. dia. x 3½ in. long; removing .012 in. in two cuts at a speed of 500 pins per hour.

COLD ROLLED STEEL ROD—⅞ in. diameter, removing .010 in. in one cut at a speed of 12½ feet per minute.

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ROUND FILE BLANKS—8 in. and 10 in. long, removing .018 in. in one cut grinding both straight and taper in one operation at a speed of 1 in. per second, or 60 in. per minute.

CLOSEST LIMITS—On hardened piston pins 1 in. dia. within .00015 in.

We can save you money on cylindrical grinding, for no other method nor machine can surpass this simple tool.

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PRECISION CENTERLESS CYLINDRICAL GRINDER

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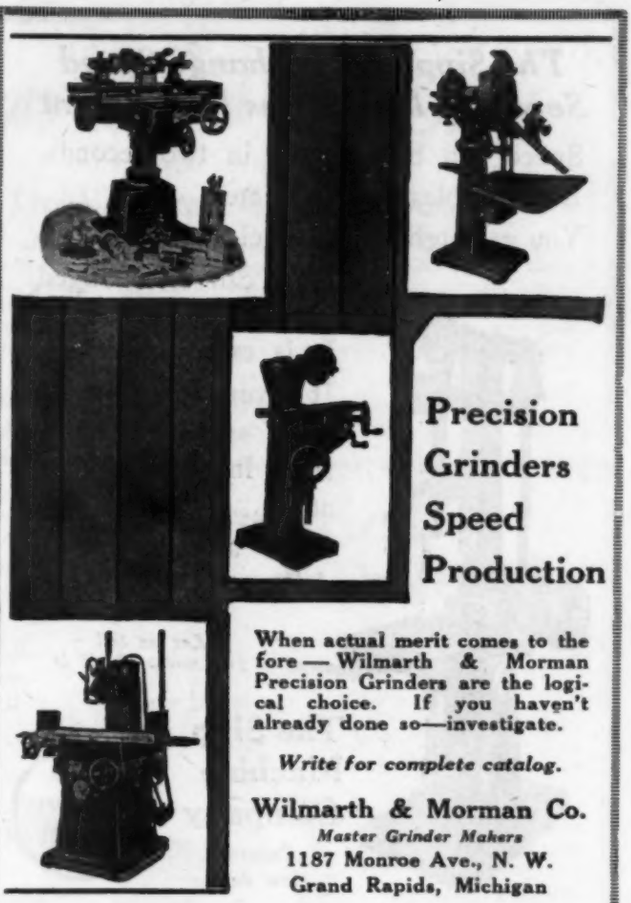

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When actual merit comes to the fore — Wilmarth & Morman Precision Grinders are the logical choice. If you haven't already done so—investigate.

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Handy Tool Grinder

The 109 Ransom Ball Bearing Grinder occupies little space, can be placed in any convenient place, requires little attention, and automatically stops when not in use.

The grinder is started by stepping on either of the two pedals located at the base of the machine in the most convenient position for the operator. When the foot pressure is released it automatically stops. There can be no forgetting to stop the machine. Enclosed cast iron guards, as illustrated, are regularly furnished. Write for specifications.

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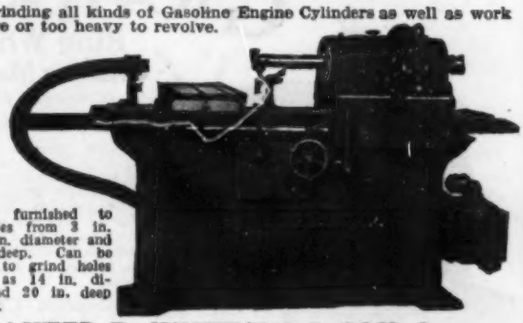
For grinding all kinds of Gasoline Engine Cylinders as well as work too large or too heavy to revolve.



Machines furnished to grind holes from 3 in. up to 7 in. diameter and 14 in. deep. Can be equipped to grind holes as large as 14 in. diameter and 20 in. deep if desired.

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Built in 3 sizes

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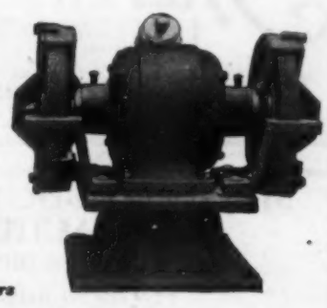
Furnished for bench or on column.



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Speed can be changed in two seconds.
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You get highest belt efficiency.

Belts can be changed in ten seconds.
It is extremely rigid.
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The spindle always runs in perfect balance.
It is a Safety First drill.

Let us tell you more about it

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Are You Willing to Better Your Drilling?

Here's the way to do it. Install a more highly efficient radial—a radial that holds to close limits—a radial that is easy to handle, well-built, rigid, long-lasting—in other words, a Morris. *Ask for the Catalog.*

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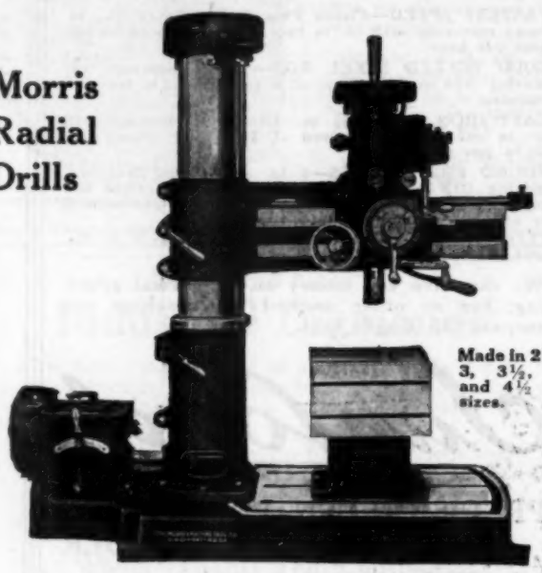

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Knee Type
For Wet Grinding

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Vertical Boring and Drilling Machines
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Leading manufacturers of Single and Multiple Spindle Drilling Machines, Cylinder Boring Machines, etc., and various types of special equipment.

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A Word That Helps You Toward Better Business

Hoefer Drillers and Auxiliary Drilling Heads drill their way through doubtful times with a degree of economy that speeds the coming of better business to your shop. *Hoefer* is the pass-word that admits better drilling methods. *Put it up to Hoefer and put it over.*

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"Hole Hog" Multiple Drillers and Borers increase the output and reduce production costs. Save in every direction. Increase the capacity of your plant by using "Hole Hogs" instead of building an addition. Tell us your needs.

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BUILT IN FOUR DIFFERENT SIZES

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Fits Any Spindle— Drills Any Pattern

3 to 12 HOLES. Built for fast Production.

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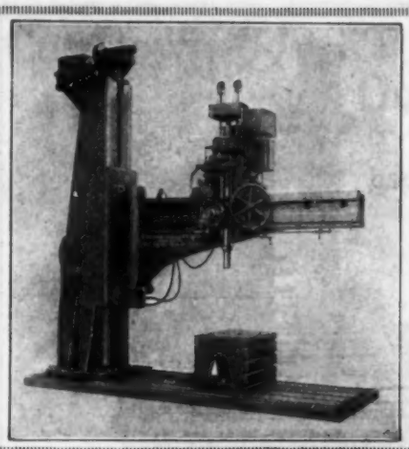

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Driving motor carried on back of head and connected to spindle through spur gearing. No belts, bevels or sliding gears. Motor counter-balances head. Head traversed by large hand wheel. Adjustable rollers bearing on top of arm insure easy movement. Spindle 3¼-in. diameter, 15-in. stroke. Arm raised and lowered by motor at top of upright. Pneumatic locking device for arm. Power pump and circulating system for lubricant. Means for controlling various movements within easy reach of operator from working position.

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These finished parts are accurately drilled, bored, reamed, faced and tapped on this Heavy Duty, Self-Oiled, ALL GEARED Drill. Every demand of service is successfully met.

No cone or inherent belts. 8 Geared Speed changes. 8 Geared Feed Changes, all under instant control without stopping spindle.

Our line of first-class, high powered ALL GEARED and Self-Oiled Drills and Tappers is a complete one. Machines that will help to cut down your production costs.

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Here is the Hjorth Submerged Drilling Attachment that can easily be applied to any upright drill. With this attachment the drill is held stationary, and the work is chucked to the spindle. There are many advantages in drilling this way, for instance — work does not become heated; drill is constantly submerged in lubricant which results in higher cutting efficiency and less regrinding; chips are kept from sticking to the drill and stock by the continuous circulation of the lubricant; revolving of the stock keeps it perfectly centered and assures accurate drilling.

Hjorth Submerged Drilling Attachment

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Write today.

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TURNER TURRET

It is adaptable to a wide range of work. Each spindle carries a different tool. All register in the same position. Simple and easy to operate. Increases output, reduces cost, insures quality. In use all over the civilized world.

Ask for Bulletin

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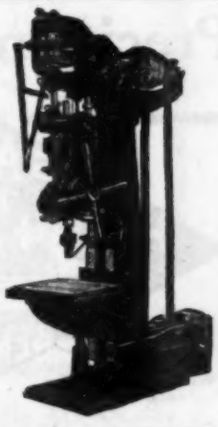

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20 and 25-in. sizes

For 65 years "Silver" products have led the field for reliability, economy and service. The 20-in.

"Silver" Upright

which showed up splendidly during the war against every conceivable difficulty, has been made larger, stronger and better.

For the repair man, the tool room, the garage man, or for general production, this sturdy, handy "Silver" is in a class by itself.

Get the catalog.

The Silver Mfg. Co.

Box 360, Salem, O.

Established 1854

The operator's ideal for handy, instant control—unlimited power—rigid precision.

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Geared Head Lathe

Gears cannot be shifted under load. Feed rod and lead screw cannot be engaged simultaneously. The few speed and feed controlling handles are placed where the operator *instinctively* reaches for them. No electric brake or electric control of any kind is necessary.

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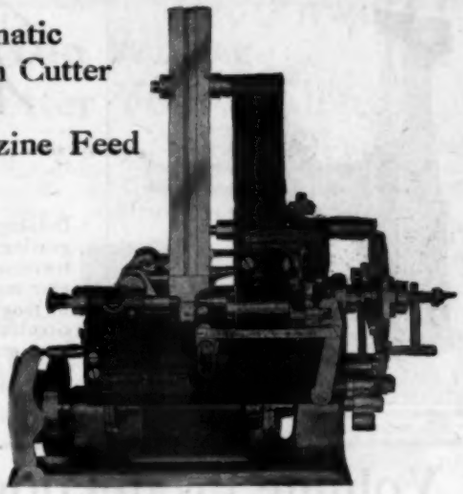
Get Bulletin No. 25 Today

The Bradford Machine Tool Co.
Cincinnati, Ohio, U. S. A.

Automatic Pinion Cutter With Magazine Feed



Rapid production on small pinions up to ½ in. diameter. The only hand function is keeping the magazine loaded —Pinions are cut automatically and accurately.

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Heavy Duty
Lathes

Have you studied the Distinctive G-K Carriage?

The G-K Heavy Duty Lathe Carriage is extra heavy, with full length bearing on each "V" and on a wide, flat bearing inside the front "V." This gives a substantial support directly under the tool rest, and shortens the bridge of the carriage. The carriage is locked by an eccentric clamp conveniently operated.

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G.K.

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THE JOHNSTON LATHE

"The most economical investment"

$185.00 Complete with Countershaft

The lathe designed for machine shops, garages, Manual Training Schools, and the home. Actual swing 9½ in., between centers 17½ in., hole in spindle ¾ in. Send for more information.

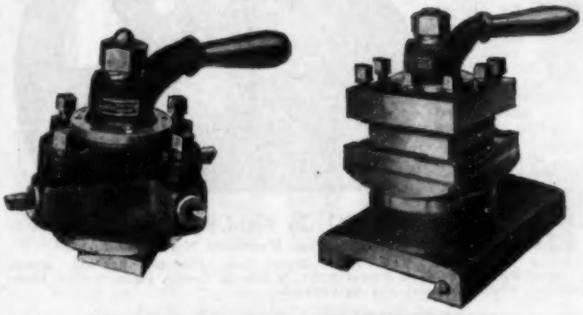
JOHNSTON MFG. CO., Arlington, N. J., U. S. A.

Precision Bench Lathes

Write for our catalog

75 East 130th St. New York City

Cut Down Cost
Cut Out Waste



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Have been made standard engine lathe equipment in hundreds of plants and shops because they can secure turret lathe production for a nominal investment. There is a cost-cutting McCrosky Turret for your job. McCrosky Catalogue No. 8 will show you.

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LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work

AUTOMATIC TURRET LATHES
For Chucking Work

VERTICAL BORING and TURNING MILLS

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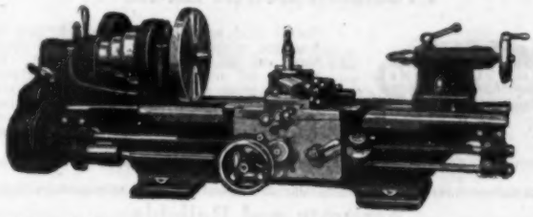
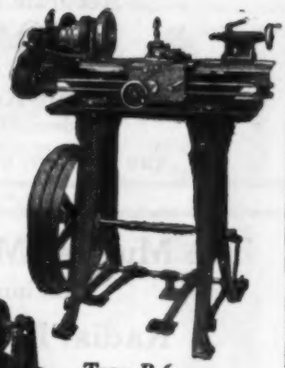
Type B-6
"The Small Lathe for the Big Job"

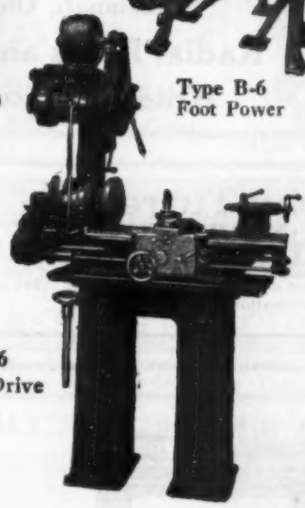


Type B-6
Bench Type



Type B-6
Foot Power

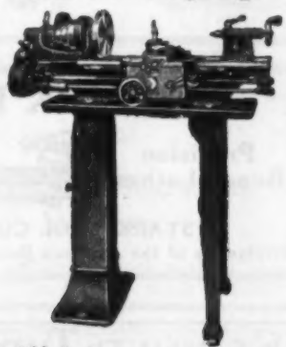
Type B-6
Standard
High Legs



Type B-6
Motor Drive

Type B-6
For Tool Room

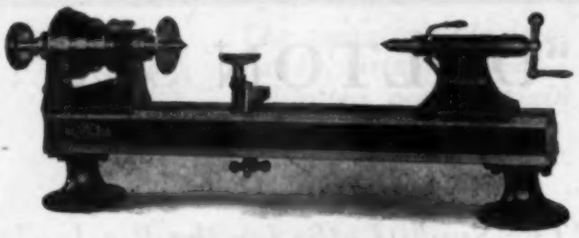
Type B-6
Semi-Cabinet High Legs



Actual Swing 8¼ inches

Bulletin on request

DALTON MANUFACTURING CORP'N
Sound Beach, Connecticut
Cable Address: "ALEDAL," Stamford, Conn., U. S. A.



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Small and medium sized work can be handled with accuracy, speed and economy on the Ames Bench Lathe. By means of our interchangeable attachments you can do turning, drilling, grinding, milling and thread cutting. A great many plants are saving money by their use. **Write for our Bulletins.**

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Owned and Operated by

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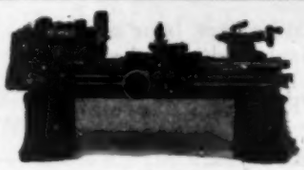

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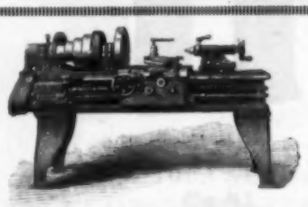

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13-15-17-19 in. Swing

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Hamilton Lathes, built in a wide range of sizes and styles, reach the peak of modern precision—plus—production. Their economy, viewed from any angle, makes it advisable for you to get complete description at once.

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Bench Millers

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Originators of the American Bench Lathe *Established 1862*

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Lathes sold with advice. Particulars on request.

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will save an unsightly patch, and a few drops of oil will prevent a burned bearing. Oil holes alone are not efficient bearing insurance. Dust and grit works in and soon plays havoc with running parts. See that your machines are provided with oil holes and then fit the holes with **Tucker Oil Hole Covers.** There's a style and size for every journal in your plant.

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Fox line of Machines includes a size and type for every Multiple Drilling and Tapping requirement. Send for Circular.

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Would you keep a separate wrench on hand for every nut that is used? Hardly! One monkey-wrench will handle dozens of different sized nuts. Then why have a separate mandrel for each job? NICHOLSON EXPANDING MANDRELS (nine to a set) fit *any* hole, round or square, ½-in. to 7-in.

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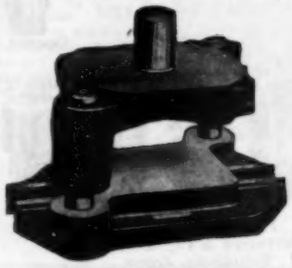
The Style-D—U. S. Sub Presses are priced right, because they are made on a quantity production basis.

The design is mechanically correct—materials and workmanship are of the highest order.



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are made in several styles and sizes and are carried in stock for immediate delivery.

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U. S. Tool Co., Inc.
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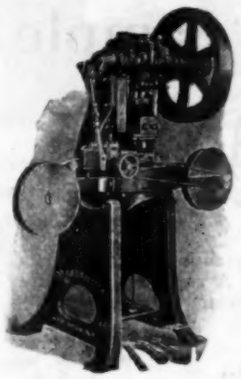

Stamp Out Your Metal Blanks With a V & O Press

Automatic feed attachment permits stamping small metal blanks at a rapid rate.

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The V & O Press Co.
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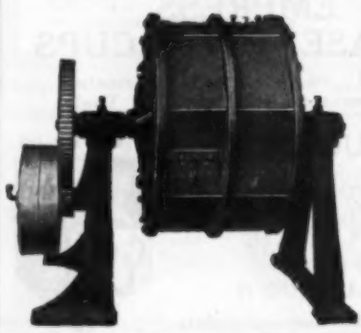
Finish Parts by the thousands the Abbott Way



It is not necessary to finish your metal parts one at a time to obtain a high quality finish. The Abbott Burnishing Process will finish them by the thousands, giving a finish better than any other method at a lower cost. The parts are put in an Abbott specially designed burnishing barrel and with Abbott hardened steel balls and tumbled. These balls are as smooth as glass and exceptionally hard. The illustration shows an Abbott 30 in. x 8 in. two compartment barrel.

If you are interested send us samples of your work to burnish free of charge. Also write for Catalog 104-T.

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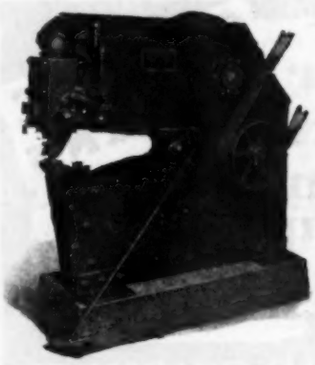

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"Armor Plate"

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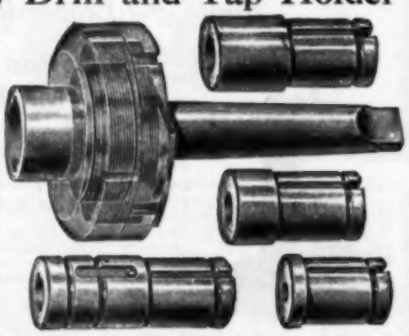
Can be furnished with special sockets with friction set to carry one or two sizes of taps, useful if sizes are constantly changing.

Nothing to *break* or get out of *order*. Made in 4 sizes covering, from 0 to 2½ in. diameter.



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The Bradley Upright Helve Hammer is a highly economical unit on variety forging.

Its flexibility permits it to cope with any amount of irregular work where frequent stops are necessary.

It meets the need for output, requires minimum repairs and is conservative in the use of power.

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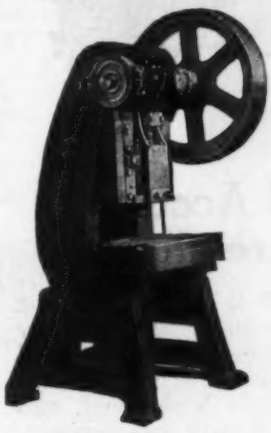

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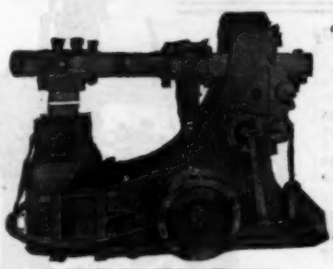

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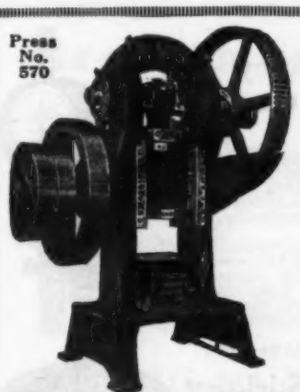

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Large or small
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The last word in Presses is

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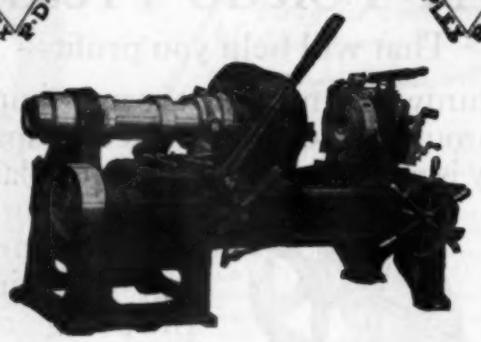

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The micrometer adjustment of the Standard Bolt Cutter is so sensitive that bolts may be cut over or under size, and dies set to again cut exact size at the will of the operator while machine is running. A graduated index eliminates errors. Dies open and close without affecting adjustment.

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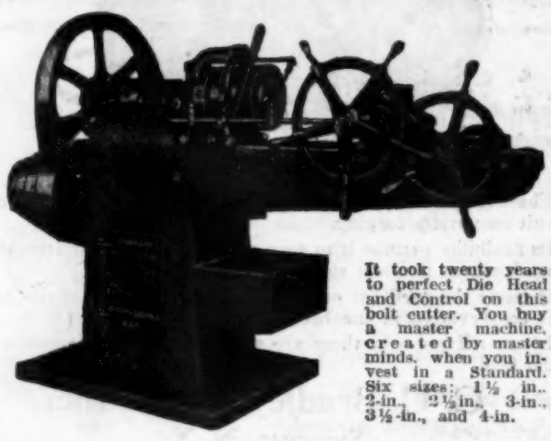

It took twenty years to perfect Die Head and Control on this bolt cutter. You buy a master machine, created by master minds, when you invest in a Standard. Six sizes: 1½ in., 2-in., 2½ in., 3-in., 3½-in., and 4-in.

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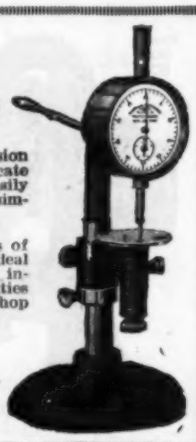

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Automatic High Speed Saw

Entirely Automatic, and Saves Time, Labor, Blades.

Put a bar of stock in this machine, start it going, and forget about it. The "Marvel" No. 5 will cut off piece after piece, at the proper dimensions, and stop when the bar is used up.

After each cut the vise is opened, stock fed, vise closed, and cut resumed all automatically.

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LEA—SIMPLEX Cold Saws

Designed, Manufactured and Sold by

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Also manufacturers of Cut Gears, Earle Centrifugal Pumps and Special Machinery

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PIPE THREADING AND CUTTING MACHINERY

All Sizes ⅛ to 18 in. inclusive

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Pipe Threading and Cutting Machinery

Hand or Power Operated

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That is why we welcome every opportunity to compare Star blades with other makes, by actual test. Write and let us tell you more about how to conduct a comparative test.

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Now Sold by
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You Will Use Them a Hundred Times a Day

Plain Shears Nos. 3 and 4.

If you use wire screen, fibre board, rubber or other sheet materials no tougher than iron or mild steel in your product, you'll not only find *Hercules Shears* handy—you'll appreciate their economy.

Capacities: No. 3—¼ in. and under. No. 4—⅛ in. and under.

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W. A. & C. F. Tucker
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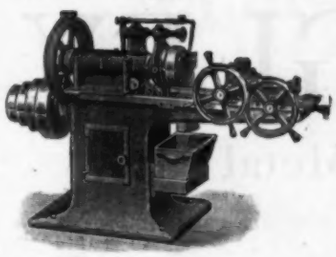

help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

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Made in four sizes for cutting shapes from ⅛, ¼, ⅜ and ½-inch plate.

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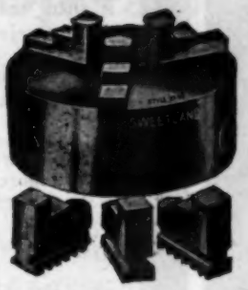
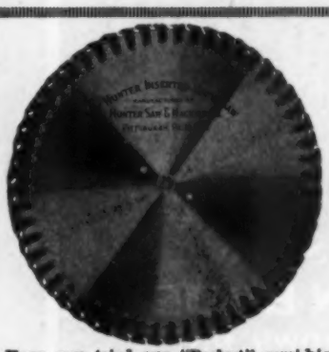
hang on till the job is finished

Chucks for Every Purpose



The Hoggson & Pettis Co.
New Haven, Conn.



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All Types of Circular Saws for Cutting Metal

Inserted tooth saws, solid tooth milling saws made of chrome alloy, semi-high and high-speed steels, hot saws, friction discs. Saw sharpening machines.

Have you tried our "Beskut" semi-high speed milling saws? They will cut costs on hard jobs.
We also manufacture and carry in stock a full line of rivet sets and chisel blanks.

HUNTER SAW & MACHINE CO., Pittsburgh, Pa.

GARVIN HEX-SQUARE TWO-WAY FIXTURE

For Butt or Straddle milling of a square or hexagon nature.
Will clamp in either a horizontal or vertical position.
Made in two sizes:
1 in. size, ½ to 1 in. cap.
2 in. size, ¼ to 2 in. cap.

MANUFACTURED BY
THE GARVIN MACHINE COMPANY
Spring and Varick Sts. 50 Years in NEW YORK CITY

The
HIGLEY
Cold Metal Saw

Catalog will be sent on application to

Vandyck Churchill Company
93 Liberty Street, New York

Almond PRODUCTS

Geared Drill Chucks
Standard Drill Chucks
Independent Lathe Chucks
Geared Scroll Lathe Chucks
Combination Lathe Chucks
Right Angle Transmission
Flexible Steel Tubing
Flexible Arms
Micrometers
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RAPID *Slip Drill CHUCK*

Drives Straight and True
Cannot Injure the Collet

American Equipment Company, Detroit

"MILFORD" HACK SAW BLADES

MILFORD

"Go By The Name"

Sample sent on request
The HENRY G. THOMPSON & SON CO., NEW HAVEN, CONN

CHUCK WITH AIR

The Lavoie Air Chucks are very simple in construction and are easy to operate. The grip is absolutely certain, as is the release. Made in seven types with six styles of jaws.

Write for particulars.

FRONTIER CHUCK & TOOL COMPANY
34 Letchworth St., Buffalo, N. Y.

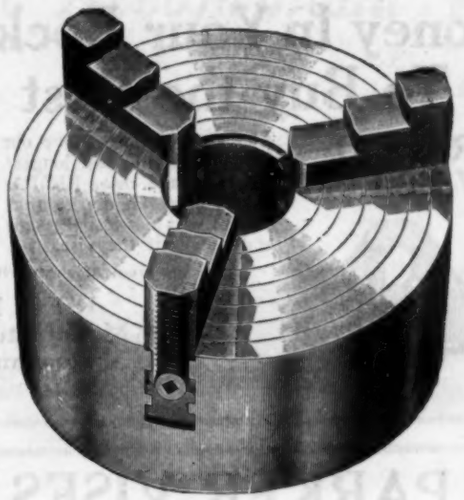
HACK "STERLING" SAWS

Diamond Saw & Stamping Works, Buffalo, N. Y.

SKINNER CHUCKS

LATHE—DRILL—PLANER—CHUCKS

THE SKINNER CHUCK COMPANY
New Britain, Conn., U. S. A.



You Can't Strain a Whiton

The body of a *Whiton Chuck* is made in one solid piece and thus cannot spring under stress. The jaws are sturdy and have bearing their entire length. For fine finishing or heavy roughing cuts, the *Whiton* has no peer.

Let us tell you something about *Whiton* range.

D. E. Whiton Machine Co.

New London, Conn.

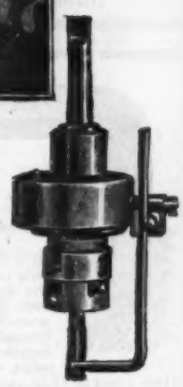
European Address:
Selson Engineering Co., Ltd., 85 Queen Victoria St., London, E. C.
"Whiton" Chucks are sold and kept in stock by principal dealers all over Europe.

Errington Auto Reverse Friction Tapper

Style C.

Tapping Blind Holes in Air Cooled Automobile Cylinder

(AMERICAN MACHINIST. Mar. 14, 1907.)



The breakage of a single tap on this job would cause an intolerable blemish in the appearance of the piece and result in heavy loss in time and money. The **Errington Sensitive Adjustment and Quick Reverse** insure perfect results. Regulate the power of the machine to **just** drive and remove all danger of **breaking the tool or injuring the work** Fool proof, fits any drill press, and taps steel as safely as cast iron. Seven sizes, ⅜" to 2".

Errington Mechanical Laboratory

Broadway & John St., New York City
Machinery Hall, 549 W. Washington Blvd., Chicago, Ill.
Phone Cortlandt 3149 831 Old South Bldg., Boston, Mass.

Horton-Morrow Chucks

Hand-Operated Self-Tightening Drill Chucks

Instant release by hand even after most severe driving strain. Drives high speed drills without slipping.

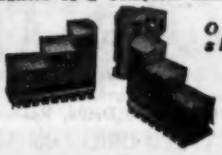
The E. Horton & Son Co., Windsor Locks, Conn., U.S.A.

We Make Nothing But Chucks

Union Chucks are always "up to the minute." Our entire efforts are devoted to the development of chucks and every dollar expended in a Union assures ample returns in service. Correct design and proper materials give Union Chucks the stamina to stand hard usage.

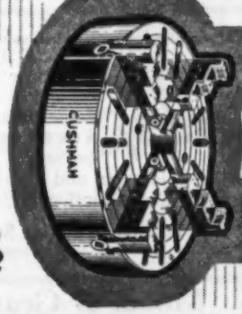
Union Manufacturing Co.

26 Cortlandt St., N. Y.
New Britain, Conn., U. S. A.
Makers of a Complete Line of Chucks



Our Catalog shows full line. Send for your copy.

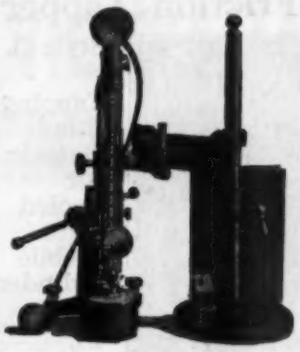
"CUSHMAN" CHUCKS 1862



The "Incomparable"

THE NEW STEEL CHUCK
Improved Body Design
Perfectly Aligned Hard-Surfaced Jaws
Hard Self-Cleaning Screws
Self-Aligning Thrust Bearings
Interchangeable Parts
THE CUSHMAN GUARANTEE

The Cushman Chuck Company
Hartford, Conn., U.S.A.



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is now used in hundreds of plants for its accuracy in hardness testing. It is direct reading and can readily be operated by anyone. Ranges from softest metals to hardest steels without adjustment. It is invaluable in ordering materials to specifications. The free booklet will interest you.

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REED VISES

Thousands in use prove our claim —Strongest and last longest. Also Reed are the most RIGID. They hold objects rigidly so that working force is not lost through spring and recoil of the vise.

Send for proof of superiority.

REED Manufacturing Company
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ALLEN Safety Set Screws

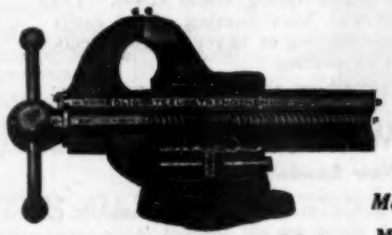
30% Extra Strength over broached hollow screws—the only other kind made. By a patented process we increase the density of the steel around the socket-holes, so that even the smaller sizes will stand all the strain the best made wrench can apply. The Allen process makes deep, perfectly-formed socket-holes—no chips in the bottom. The entire length of the ALLEN is utilized either for solid metal at the point, or depth of socket for the wrench. All sizes in stock from ¼ in.; to 1½ in.; any length, point or thread. Also Pipe Plugs Socket-Head Cap Screws. Tap Extensions and Tire Wrenches—Allen process. Complete descriptive catalogue on request.

THE ALLEN MFG. CO. 129 SHELDON ST. HARTFORD, CONN

PARKER VISES

PIONEERS 1842 — LEADERS EVER SINCE

STRENGTH



With the solid steel bar in the slide (DD) and the solid under-portion (AB) Parker Vises are the strongest vises in the world.

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drawing instruments,

Pease "Chicago-Made" Drawing Instruments excel every other line, both domestic and imported, in accuracy, finish and quality. Various assortments in morocco pocket-style cases and separate instruments are illustrated and priced in our catalog D-21.

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AMERICAN THREAD PRODUCERS

Taps and Dies that cut clean and accurate.
All sizes and pitches furnished promptly
American Tap & Die Co., Greenfield, Mass.

Model B (Five wheels)
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Model B Gear Counter

will give you your accurate production. Tested 20,000 per hour.

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COWLES TOOL COMPANY
Cleveland, Ohio
Cutter Designers and Manufacturers

T-W INDEPENDENT LATHE AND UNIVERSAL GEARED SCROLL CHUCKS

Contain exclusive features giving Strength, Service, Durability, Satisfaction.

TERKELSEN MACHINE CO.
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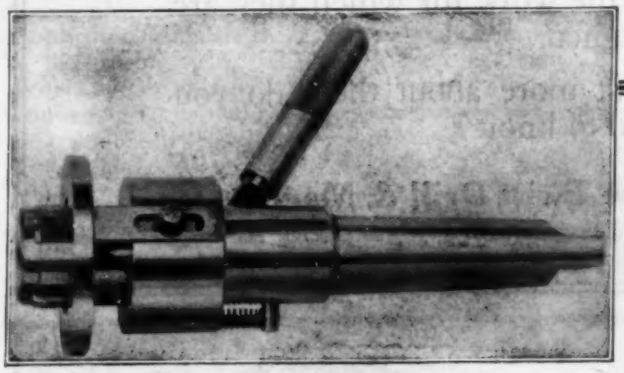
FASTFEED

High Speed Drills, Reamers and Special Tools

FASTFEED DRILL AND TOOL CORPORATION
TOLEDO, OHIO

We Recommend This Tap for Cutting Thread in Steel Flanges and Similar Jobs



This tap not only saves power, but gives you clean, perfect threads in less time.

We make the famous Victor Collapsible, Adjustable Taps and Hand Collapsible Taps which save the time formerly required in backing out. Also, Solid Adjustable Hand Taps with which you get years of service. You should have the catalog that describes the complete VICTOR Thread-cutting line.

VICTOR Cam Style Collapsible Tap

Have you been using ordinary taps on this kind of work? Then you know the power they take and the trouble they make!

You'll appreciate the fact that the chasers on this tap are short and straight, instead of tapered. Chasers recede as they enter the work and a cam moving along the correct angle gives them the proper taper in forming the thread. Pressure against the trip collar gives the tap its action.

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Advertise your Surplus Facilities in the Market Place of the Machinery Industries—

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CONTRACT WORK

SECTION

Why Waste Time Grinding Lathe Centers *when the* DETROIT Inserted Point CENTER

requires only ten seconds to change a point which can be done without removing the sleeve from the machine?

The Detroit Center consists of only two parts—a high speed steel center or point and a sleeve of hardened steel. The sleeve is not subject to wear, is permanent and takes up all wear insuring perfect alignment and rigidity. Both hole and center are ground to a Morse taper.

Requires less attention—is more dependable—wears much longer than ordinary steel.

Order a few for test on your machines.

Dimensional chart and price list on request.

Detroit Twist Drill Company

Detroit, Michigan

Canadian Detroit Twist Drill Co., Limited, Walkerville, Ontario.

(21)

Morse Cutters

Do the work for which they are designed.

What more about them do you need to know?

Morse Twist Drill & Machine Co.
New Bedford, Mass., U. S. A.

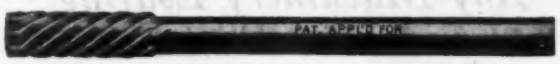
SOMETHING NEW IN WRENCHES

Are you interested in an extra long featherweight wrench, drop forged from Chrome Nickel Steel heat treated and oil tempered? Light, stiff and tough.

Write for free catalogue

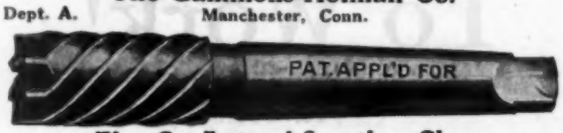
Armstrong Bros. Tool Co.
"The Tool Holder People"
315 N. Francisco Ave.
Chicago, U. S. A.

THE GAMMONS HELICAL CHUCKING REAMER AND END MILL



They do better work and do it faster. There's a reason. Note the design. It combines a fast cutting end with a smooth cutting body. Chatter is eliminated and perfect work results. Let us tell you more about them. What size do you want price on?

The Gammons-Holman Co.
Dept. A. Manchester, Conn.



They Cut Fast and Smooth as Glass

Latrobe
HIGH SPEED DRILLS

Latrobe Drills are Highest Quality in material and workmanship—they are rugged drills—built for speed, accuracy, long life. **Latrobe** Drills are made from hot rolled special section high speed steel [as shown above] hot twisted and the grooves are milled—therefore **Latrobe** drills have all the strength of a forged drill plus the accuracy of a milled drill.

WRITE FOR CATALOG

LATROBE TOOL COMPANY
Manufacturers: LATROBE, PA.

TWIST DRILLS, CUTTERS, REAMERS AND SPECIAL TOOLS

NATIONAL
TWIST DRILL & TOOL CO.
DETROIT, U.S.A.

CASLER Offset Boring Head

Use it on your milling machine. It is particularly handy on jig and fixture work. Has micrometer adjustment to limits of .001 inch. Write for Catalog "H."

Marvin & Casler Co., Canastota, N. Y.

BUTTERFIELD

Butterfield Taps are the biggest buy you can make in the tapping field. They cut cleaner and last longer, due to scientific temper and correct design. You may get a tap at a shorter cost, but you can't get one with a longer record for good tapping.

We have used up the best part of two-score years to make **Butterfield Taps** better and opinions of users prove that our efforts have not been in vain.

You'll get further facts in the Catalog.

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Division Union Twist Drill Co.

Derby Line, Vt., U. S. A.

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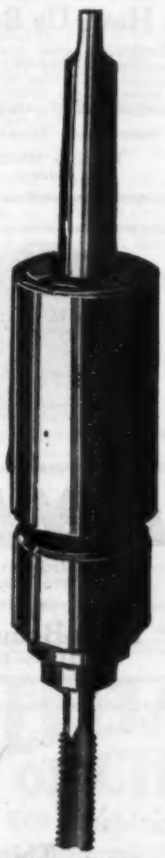
No Tap Breakage When Tapping Blind

You can tap a close pattern of holes with the APEX SAFETY TAP HOLDER, and its safety factors are an assurance against tap breakage when tapping blind.

THE

APEX
Safety Tap Holder



because of its design, is applicable to both single and multi-spindle drilling machines.

In these days of strict economy, it is consoling to know that expensive machine taps are not required with the "APEX." This is an item in cost lowering worth thinking about—*seriously.*

Go ahead of your competitor or he will go ahead of you. *Write for further details now.*

The Apex Machine Co.

Dayton, Ohio

Manufacturers of Safety Tap Holders and Universal Joints

Representatives:
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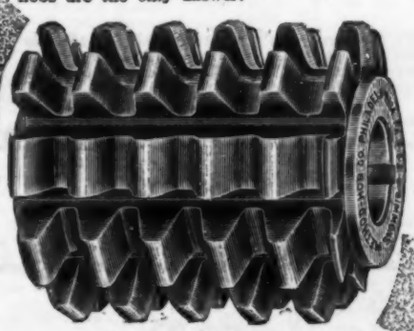
Now— Every Hob can be Generated

Don't pin your chances of exact duplication on Hobs **formed to a template.** When a worn out hob must be replaced, you can't be sure the new hob is a mechanical duplicate unless all chances for error in making the hob are eliminated. **Generated hobs are the only answer.**

SIMMONS METHOD-HOB COMPANY PHILADELPHIA, PA.



We are now prepared to hob gears up to 18 in. diameter

Ask for Prices

Hobs formed to a template are subject to human error—but

SIMMONS METHOD-HOB COMPANY PHILADELPHIA, PA.

SIMMONS METHOD-HOBS

are mechanically accurate and uniform—just as generated gears are mechanically accurate.

Learn about them—write to

Simmons Method-Hob Co.
2nd St. and Duncannon Ave.
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"They May Cost a Little More— But they DO A WHOLE LOT MORE!"

The best file buyer is the one who buys the most service, and best service per dollar!

If a STAR & CROSS file costs 5% or 10% more on the dozen, and actually gives 50% longer service than ordinary files sold on a price basis, there's no question as to which is the better buy!

Mechanics who have tried them have no doubts about the superiority of AMERICAN SWISS FILES. They equal the famous foreign-made files in cutting edge—and surpass them in uniformity of temper and spacing!

We can save you money not only on the file bill, but on the time of your high priced mechanics. Let us go into this proposition fully.

AMERICAN SWISS FILE AND TOOL CO.
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Sales Office:
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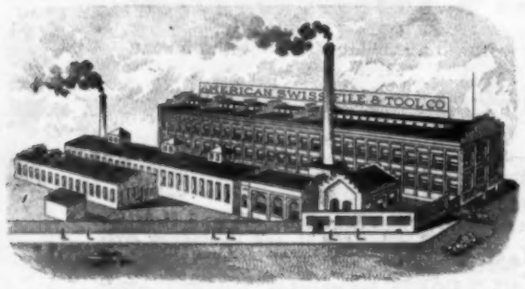

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N.-C. Tools are known in every corner of the World!

Wherever metal is machined, "N-C" cutting tools are known for their reliable service. In 1922 you can't afford to take chances on such a vital factor as tools. If you are not a user of "Extra Service" cutters, etc., you should by all means send in a trial order.

Have you tried them?

THE NATIONAL TOOL CO.
Cleveland, Ohio

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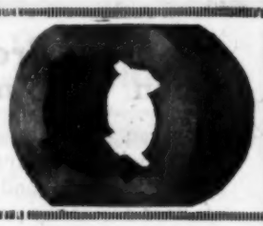
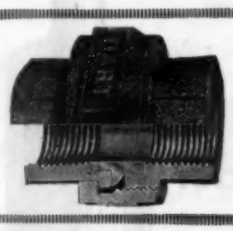
Have Us Broach It

Broaching cuts cost on keyways, splines, oil grooves, gear teeth, and countless regular or irregular shaped holes. Send your problems to the originators of commercial Broaching

Remember—"Lapointe of Hudson"

Lapointe Machine Tool Co.
Hudson, Mass.





Absolutely Tight

non-corrosive bronze seats accurately ground together make **Dart Unions** non-leaking. A free sample on request. **Write for catalog and price list No. 20.**

E. M. Dart Mfg. Co. Providence R. I.

The Fairbanks Co., Sales Agents
Canadian Factory, Dart Union Co., Ltd., Toronto.

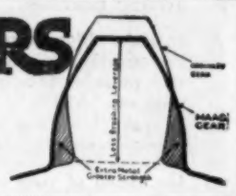
Ask your dealer for prices

MAAG GEARS

Strongest at the Base
Where Others are Weakest

Catalogue No. 265

Niles-Bement-Pond Co.
111 Broadway, New York



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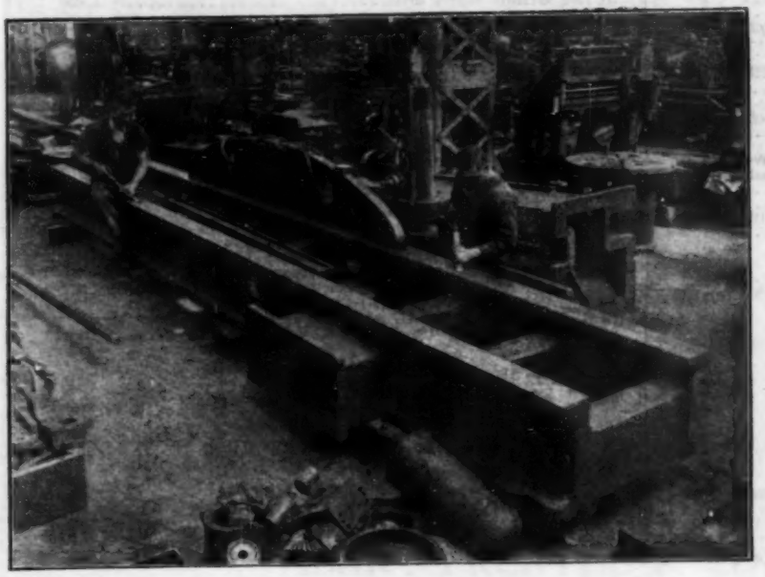
ReMANUFACTURED
-(ORIGINATED BY US)-
MACHINE TOOLS

REG. U. S. PAT. OFFICE

Hand Scraping the ways of a planer—a step in the ReManufacturing Process.



The four fundamentals of a good machine tool, which are emphasized in the ReManufacturing Process, are Accuracy, Alignment, Construction, and Performance.

Lacking any one of these qualities, a tool could not merit this guarantee.

If, for any reason whatsoever, you decide not to retain your ReManufactured Tool, return it to us within 30 days from date of purchase (freight prepaid) and we will buy it back at the original price.

The Green List*

of Guaranteed ReManufactured Machine Tools

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30—14 in. x 6 ft. Reed Ext. Hvy. Pl. Turning.
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6—16 in. x 6 ft. Reed.
8—17 in. x 6 ft. Le Blond Mfg. Auto.
22—18 in. x 8 ft. Boye & Emmes, Q.C.G.
20—19 in. x 8 ft. Le Blond Hvy., Q.C.G.
13—20 in. x 8 ft. Le Blond, Q.C.G.
89—20 in. x 8 ft. American Q.C.G.
3—20 in. x 10 ft. Lodge & Shipley, Q.C.G.
26—21 in. x 10 ft. Le Blond Hvy. Q.C.G.
19—22 in. x 8 ft. Davenport.
8—25 in. x 10 ft. Le Blond Hvy. Q.C.G.
28—26 in. x 10 ft. Niles, Bement, Pond.
1—26 in. x 11 ft. Wickes.
13—26 in. x 9 ft. Bridgeford, Q.C.G.
70—26 in. x 10 ft. Bridgeford, Q.C.G.
22—26 in. x 12 ft. Bridgeford, Q.C.G.
1—26 in. x 18 ft. Bridgeford, Q.C.G.
1—26 in. x 20 ft. Bridgeford, Q.C.G.
6—30 in. x 11 ft. American Gd. Hd.
1—30 in. x 20 ft. American Gd. Hd.
19—32 in. x 12 ft. Pittsburgh, Q.C.G.
2—36 in. x 14 ft. Johnson Trip. Gd.
1—36 in. x 19 ft. Johnson Trip. Gd.
15—36 in. x 30 ft. Pittsburgh Gd. Hd.
4—36 in. x 37 ft. Niles, Bement, Pond Trip. Gd.
4—40 in. x 12 ft. Fifield Trip. Gd.
1—40 in. x 18 ft. Fifield Trip. Gd.
2—45 in. x 24 ft. Pond Trip. Gd.

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3—16 in. Walcott, Cone Drive.
1—16 in. Walcott, S.P.D.
1—20 in. Walcott.
1—24 in. Walcott, Cone Drive.
2—24 in. Walcott, S.P.D.
6—26 in. Niles, Bement, Pond.
1—34 in. x 26 in. x 8 ft. American Planer.
2—36 in. x 13 in. x 14 ft. Niles, Bement, Pond Frog & Switch.
1—56 in. x 56 in. x 10 ft. Gray, 2 hds.
1—72 in. x 72 in. x 14 ft. Niles Planer, 4 hds.
1—96 in. x 72 in. x 20 ft. Bement, Miles, 4 hds.

MILLERS

49—No. 6 Whitney Hand.
60—Garragus Hand.
22—Van Norman Hand.
60—No. 3½ Fox P. F.
1—No. 0 Brown & Sharpe.
1—No. 2 Rockford, Plain.
1—No. 2-A Milwaukee, Plain.
1—No. 2-B Milwaukee, Plain.
1—No. 20 Ohio, Plain.
1—No. 2 Ohio, Plain.
1—No. 24 Ohio, Universal.
1—No. 2 Cincinnati, Plain.
1—No. 1 Dow.
32—12 in. Cincinnati Mfg.
2—No. 4 Cincinnati Pl. S.P.D.
2—No. 4 Becker Vertical.
105—No. 4 Hendy Lincoln.
25—No. 4 Loew-Victor Lincoln.
11—No. 12 Pratt-Whitney Lincoln.
50—No. 7-H Becker Lincoln.
2—Type B-34 in. Briggs.
2—18 in. Cincinnati Automatic.
7—Putnam Semi-Automatic.
1—17 in. x 10 Newton, 3 hds.
1—No. 1½ Newton Duplex.
1—24 x 6 Ingersoll, 3 hds.
1—48 in. x 10 Newton Slab.

TURRET & SCREW MACHINES

8—⅝ in. Pratt & Whitney Screw.
1—1 in. Pratt & Whitney Screw.
8—1 in. Warner & Swasey, No. 2.
5—1 in. Foster, No. 2.
5—1¼ in. Foster, No. 3.
3—1½ in. Warner & Swasey, No. 4.
4—No. 4 Warner & Swasey Universal.
15—1½ in. Wood, No. 4.
1—1½ in. Southworth, No. 4.
1—2 in. Brown & Sharpe, wire feed, No. 6.
2—2 in. Pratt & Whitney Screw.
1—2 in. Wood, No. 6.
2—3 x 36 Jones & Lamson.
1—3 x 36 Acme.
4—14 in. Warner & Swasey Turret.
2—20 in. Pratt & Whitney Chuck.
2—No. 3-A Warner & Swasey.
25—24 in. Steinle.
4—No. 75 4-spdl. National Acme.

GRINDERS

12—American Drill.
1—No. 2 Garvin-Hole.
2—No. 70 Heald Int.
1—12 in. x 96 in. Landis Pl.
1—No. 2 Bath Surface.
1—8 in. x 48 in. Thompson Surface.
2—12 in. x 36 in. Landis Plain.
1—12 in. x 36 in. Modern Plain.
1—20 in. x 96 in. Landis Plain.
1—12 in. x 36 in. Cincinnati Univ. No. 2.
3—6 in. x 32 in. Norton, Plain.
1—No. 2 Oesterlein, Cutter.
2—No. 3 Oesterlein, Universal.

UPRIGHT DRILLS AND RADIALS

1—2-spl. Henry & Wright.
1—3-spdl. Allen.
18—6-spdl. Allen.
3—No. 6-B Henry & Wright Sens.
1—20 in. Silver.
1—25 in. Silver Sliding Hd.
3—3 ft. American Sens. Radial.
1—6-spdl. Barnes, gang.
1—3 ft. Western Radial S.P.D.
1—3½ ft. Western Radial S.P.D.
1—4 ft. Western Radial S.P.D.
1—5 ft. Western Radial S.P.D.
1—6 ft. Western Radial S.P.D.

BORING MILLS

1—30 in. Gisholt.
1—34 in. Colburn.
1—10 ft. Niles Vertical.
1—4 in. Bar Niles Hor.
1—Beaman & Smith Hor., 2 hds.
1—2-spdl. Espen-Lucas, 2 hds.

MISCELLANEOUS

2—No. 4-B Cochran-Bly Auto. Cold Saws.
18—Pilton Slotters.
6—4 in. Pratt & Whitney Thd. Millers.

If the tools you want are not listed here, write and ask us.

HILL, CLARKE & CO
OF CHICAGO
649 Washington Boulevard

Genuine Bargains

Here is a list of equipment, just purchased from a manufacturing plant, that we are offering at prices that will move them quickly.

Some of them are *Brand New.* *All* are late type tools and in *first class* working condition.

LATHES

13 in. x 6 ft. HENDEY, taper attach. and draw bar	$475
14 in. x 6 ft. SIDNEY (NEW)	475
16 in. x 6 ft. SIDNEY (NEW)	490
20 in. x 8 ft. WALCOTT (95% NEW)	725
22 in. x 10 ft. REED (90% NEW)	490
13 in. x 6 ft. REED-PRENTICE, taper attach	325
No. 5½ SLOAN & CHACE bench lathe, grinding attach.	125

MILLERS

No. 2 CINCINNATI HI-POWER UNIVERSAL, VERTICAL MILLING ATTACH. (90% NEW)	1300
No. 2 CINCINNATI UNIVERSAL, cone driven	900
No. 2 ROCKFORD UNIVERSAL, vertical milling attach. (90% NEW)	1150
No. 1 GARVIN UNIVERSAL	575
No. 2A BROWN & SHARPE UNIVERSAL (90% NEW)	950
No. 2 BROWN & SHARPE PLAIN, with dividing heads	400
No. 1-½ B BROWN & SHARPE PLAIN (90% NEW)	500
No. 3 BROWN & SHARPE PLAIN	250
No. 2 BROWN & SHARPE VERTICAL with circular milling attach.	500
No. 1-½ AMERICAN PLAIN with dividing heads	375
No. 3-½ FOX PLAIN	135
CINCINNATI 12 in. PLAIN	175
TYPE "A" BRIGGS	175

PLANERS—SHAPERS BORING MILLS

20 in. GOULD & EBERHARDT, back geared	650
7 in. RHODES (90% NEW)	175
20 in. AMERICAN—MOTOR DRIVEN	650
16 in. WHIPP (NEW)	500
24 in. x 24 in. x 6 ft. GRAY—2 HEADS	750
34 in. COLBURN VERTICAL BORING MILL	750
32 in. KING VERTICAL BORING MILL (90% NEW)	950

DRILLS

14 in. WASHBURN HIGH SPEED SENSITIVE (NEW)	90
14 in. MYERS SENSITIVE	62
No. 11 NATCO MULTIPLE DRILL—8 Spindles	385
FOX MULTIPLE DRILL—12 Spindles	350
AVEY SENSITIVE, single spindle	125
20 in. CHAMPION (NEW)	115
HENRY & WRIGHT SENSITIVE 3 spindle Class L	215
4 SPINDLE ADJUSTABLE spindles and adjustable table	125
HAMMOND RADIAL (NEW)	390
QUINT 6 Hole turret drill	65

GRINDERS

No. 1 BROWN & SHARPE UNIVERSAL	425
9 in. x 18 in. NORTON PLAIN	475
14 in. PRATT & WHITNEY VERTICAL SURFACE	675
No. 1-½ CINCINNATI CUTTER (95% NEW)	275
BROWN & SHARPE TYPE SURFACE, with magnetic chuck	250
No. 1-½ DIAMOND BENCH POLISHING JACKS	17

SCREW MACHINES

5A POTTER & JOHNSTON AUTOMATIC	370
No. 10 FOSTER geared head, power feeds, (90% NEW)	650
No. 4 FOSTER geared head	350
No. 3 FOSTER plain head, (90% NEW)	375

WOODWORKING

No. 55 CRESCENT UNIVERSAL WOODWORKER	450
6 in. AMERICAN BENCH JOINTER	75
PEERLESS VERTICAL SANDER (90% NEW)	225
PEERLESS HORIZONTAL SANDER (90% NEW)	175
24 in. x 8 ft. FAMOUS PLANER (NEW)	375

MISCELLANEOUS

No. 7B JARECKI PIPE MACHINE	300
No. 3 LAPOINTE BROACHER, single spindle	375
40 LB. BRADLEY HELVE HAMMER	300
25 LB. BRADLEY HELVE HAMMER	275
THURSTON DIE MILLER (NEW)	125
No. 2B COCHRANE & BLY COLD SAW	115
No. 11 COCHRANE & BLY SAW SHARPENER (90% NEW)	135
No. 2 BAIRD FOOT PRESS	18
RICKERT SHAEFFER HORIZONTAL TAPPER (90% NEW)	75

All machines for immediate delivery and all are offered subject to prior sale.

Standard Machinery Company, 453 Chapel St., New Haven, Conn.

PRE-WAR PRICES!

USED TOOLS

PARTIAL LIST

1—One-spindle Allen Drill Presses.
2—Three-spindle H. & W. Drill Presses.
1—Three-spindle Sipp Drill Press.
1—Five-spindle T. & F. Drill Press.
1—Dow No. 1 Knee Type Plain B. G. Miller.
2—No. 1 Hendey Knee Type Plain Millers.
1—No. 12 P. & W. Lincoln Miller.
1—No. 32 Kempsmith Lincoln Miller.
1—Briggs Standard Type "A" Miller.
4—Briggs 58-in. Table Type "A" Millers.
2—No. 6 Whitney Hand Millers; two-step cone.
2—Stark No. 3½ Bench Lathes.
4—Bryant No. 6 Chucking Grinders.
3—Rivett No. 103 Internal Grinders.
2—No. 0 B. & S. Bench Tool Grinders.
1—No. 2 B. & S. Universal Grinder.
3—No. 2 B. & S. Surface Grinders.
1—6 in. x 30 in. Morse Plain Cyl. Grinder.
1—No. 10 Foster Turret Lathe.
8—No. 1-A Standard Foot Presses (new).
1—Waterbury Farrel (not inclinable). Standard Open Back Press, about size No. 18 Bliss.
25—No. 1 Baird Bench Presses.
1—B. & S. Die Trimmer.
1—No. 2 B. & S. Hand Screw Machine.

PURINTON & SMITH
31-41 Edward St., Hartford, Conn.

Special Bargains in Grinders

2—No. 16 Blanchard High Power Vertical Surface, direct motor drive, 26-in. magnetic chuck, condition as good as new, extremely accurate.

2—14-in. Pratt & Whitney Vertical Surface Grinders, motor driven with 15-hp. motors, rotary plain table, one with mag. chuck; used a short time; accurate on production to .0005.

6—Person-Arter 8-in. Rotary Surface, with mag. chucks; accurate to .00025 and in A-1 condition.

20—No. 2T Van Norman Auto Ball Race Grinders for radial or thrust bearings or any mechanical perfect groove or radius; accurate to .0005 and A-1 condition.

Lot of other Grinders and good new and used equipment.

IDEAL MACHINERY CO.
Plainville, Conn., U. S. A.

FRANK TOOMEY, INC.

127-129-131 N. Third St., Philadelphia, Pa.

MACHINE TOOLS IN STOCK

LATHES	New Sidney, all sizes, 10 in. to 36 in., any length. New Carroll-Jamieson, 13 in., 15 in., 16 in., any length bed. New Johnston Bench Hi-duty, 9 in. x 36 in. Used 42 in. Pond, car wheel Lathe. WRITE FOR USED LATHE LIST.
TURRETS	Used 2¾ in. Gridley, No. 4 and 6 Warner & Swasey. Used No. 1, No. 6 Bardons & Oliver, No. 21 Gisholt. MANY OTHER USED TURRETS.
DRILL PRESSES	Full Line Superior Drills. Full Line Champion Drills. Full Line Buffalo Drills. Full Line Excelsior Drills. Full Line Sensitive Drills. 42 in. New Standard Plain Radial. ALSO USED DRILLS AND RADIALS.
BORING MILLS	Used 42 in. Bullard Boring and Turning. Used 3 in Binsse Horizontal Mill.
SHAPERS	Full Line Steptoe Shapers. 7 in. Rhodes Shaper.
PLANERS	Used 36 in. x 36 in. x 10 ft. Cincinnati, 3 Hds. Motor. Used 24 in. x 24 in. x 6 ft. Pease, 1 Head. Used 24 in. x 24 in. x 8 ft. Hendey, 1 Head. Used 48 in. x 48 in. x 16 ft. Flather, 4 Heads. Used 16 in. x 16 in. x 42 in. Walter, 1 Head.
MILLERS	Various Sizes, New and Used. Brown & Sharpe, Garvin, American, Dow, Burke, Steptoe.
PUNCHES	Line of Buffalo Forge Armor Plate.
SHEARS	Line of Royersford Foundry & Mch. Co.
PRESSES	Line Hendley-Whittemore, Beloit. Line Max-Ams. Line of Ferracute. VARIOUS USED MACHINES.

Write for further list of Hack Saws, Hammers, Bolt Cutters, Pipe Machines, Slotters, Keyseaters, Grinders, Etc.

FRANK TOOMEY, Inc., 127-129-131 N. Third St., Philadelphia, Pa.

SLOTTERS

10-in. Newton.
16-in. Betts.

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Drawings, Patterns, Jigs and Fixtures, and completed parts of iron planers from 24 in. to 42 in. wide. For further details write this office.

MORLEY MACHINERY CORPORATION
215-217 North Water Street
Rochester, New York

SECOND-HAND MACHINE TOOLS

DRILLS

1 spdl. Avey ball bearing.
2 spdl. Avey ball bearing.
3 spdl. Henry & Wright ball bearing.
3 spdl. Taylor & Fenn.
4 spdl. Francis Reed.
20 in. Prentice Bros. stationary head.
20 in. Prentice Bros. sliding hd., B.G., P.F.
23 in. Rockford sliding hd., B.G., P.F., Tapping att.
24 in. Cincinnati-Bickford sliding hd., B.G., P.F.
26 in. Sibley sliding hd., B.G., P.F.
42 in. Cincinnati-Bickford sliding hd., B.G., Tapping att.
No. 12 Natco multiple spdl. tapping att.
No. 13 Natco multiple spindle drill.
No. 14 Natco multiple spdl.
No. 30 Bausch multiple spdl.
3 ft. Cincinnati-Bickford radial, tapping att.
4 ft. Dreses radial, tapping att.
5 ft. Cincinnati-Bickford full universal radial.
4 ft. Western (Full universal) radial, tapping att.
Baker Bros. & Colburn manufacturing type drills.

LATHES

No. 5 Rivett Precision, with slide rest.
12 in. x 6 ft. Prentice Bros. Tool Room, taper att.
14 in. x 6 ft. Flather Tool Room, taper att.
16 in. x 6 ft. Lodge & Shipley Tool Room, taper att.
16 in. x 8 ft. Lodge & Shipley Tool Room, taper att., geared hd., M.D.
24 in. x 10 ft. Lodge & Shipley, C.R., P.C.F. taper att.
26 in. x 12 ft. Putnam, C.R., P.C.F.
32 in. x 14 ft. Boye-Emmes, C.R., P.C.F.
32 in. x 14 ft. Hamilton, C.R., P.C.F., triple geared.
38 in. x 20 ft. New Haven, C.R., P.C.F.
50 in. x 22 ft. Fifield, C.R., P.C.F., triple geared.

BORING MACHINES

3 in. dia. bar, Lucas hor., table type.
4 in. dia. bar, Detrick & Harvey, hor., floor type.
24 in. Colburn turret head, vertical.
38 in. Niles, 2 reg. heads.

SCREW MACHINES AND TURRET LATHES

⅝ in. capacity Brown & Sharpe, wire feed.
1 in. capacity Acme, wire feed.
1⅛ in. capacity Acme, wire feed.
1½ in. capacity Acme, wire feed.
2¼ in. capacity Acme, wire feed.
16 in. and 18 in. Acme Universal, Fox type.
No. 3 Acme Universal 3½ in. capacity flat turret.
2¼ in. and 3¼ in. Jones & Lamson bar or chucking.

MILLERS

No. 2, 3 and 4 Cincinnati, plain.
No. 2A, 5 and 9 Kempsmith, plain.
No. 3 and 4 Cincinnati, vertical.
No. 2A, 4B and 5 Becker, vertical.
No. 2 B. & S. Universal.
No. 1 Cincinnati Type M, Universal.
No. 6 Whitney, hand.
36 in. x 10 ft. Newton, face slab type.

GRINDERS

3 in., 6 in., 10 in., 18 in. Swing Norton, pl. mfg. type.
10 in. x 30 in. Landis, pl. mfg. type.
12 in. x 120 in. Landis, pl. mfg. type.
12 in. x 36 in. and 48 in. Cincinnati, pl. mfg. type.
No. 2 Cincinnati 12 in. x 36 in., universal.
No. 3 Cincinnati 12 in. x 48 in., universal.
No. 1 Cincinnati cutter and reamer grinder.
No. 1 LeBlond cutter and reamer grinder.
No. 1 Norton cutter and reamer grinder, pwr. feed table.
No. 34 Van Norman, internal.
No. 6 Rivett, internal.
No. 60 Heald, cylinder (very good).
No. 11 Rivett Ball Race, with power, oscillating att.
Saxon face grinder.
10 in. Garrigus rotary, with magnetic chuck.
1—24 in. x 12 in. Surface (No. 1 Diamond).
No. 16 Blanchard grinders.
16 in. and 20 in. disc. grinders.

SHAPERS AND PLANERS

14 in. Pratt & Whitney crank shaper.
14 in. Springfield crank shaper
16 in. Ohio plain crank shaper.
16 in. and 20 in. Gould & Eberhardt crank shapers, back geared.
24 in. Stockbridge crank shaper, back geared.
15 in. and 24 in. Hendey friction shapers.
24 in. x 24 in. x 6 ft. Flather planer, 1 hd.
26 in. x 34 in. x 7 ft. Gray planer, 1 hd.
36 in. x 36 in. x 8 ft. Pond planer, 2 hds.
36 in. x 36 in. x 12 ft. Pond planer, 2 hds.
36 in. x 30 in. x 14 ft. Cincinnati planer, 3 hds.
36 in. x 36 in. x 12 in. Cincinnati planer, 4 hds.
40 in. x 30 in. x 12 ft. Cincinnati planer, 2 hds.
42 in. x 42 in. x 12 ft. Cincinnati planer, 3 hds.
48 in. x 36 in. x 12 ft. Cincinnati planer, 3 hds.
48 in. x 48 in. x 15 ft. Sellers planer, 3 hds.
66 in. x 60 in. x 30 ft. Bement planer, 3 hds.

MISCELLANEOUS

No. 00 S. & S. Hobbing, gear cutter.
No. 000 S. & S. Hobbing, gear cutter.
36 in. B. & S. gear cutter.
36 in. Cincinnati gear cutter.
No. 3 Lapointe broaching machine.
3 in. P. & W. centering machine.
No. 72 Ferracute.
8 in. x 8 in. air compressor.
½ in. and 1 in. 6 spdl. Acme nut tappers.
12 and 13 PPP. & W. profilers.
No. 6A National butt welder.
4 in. Baker Bros. tapping machine.

We have a number of machines not mentioned in this list. Send us your inquiries.

HENRY PRENTISS & COMPANY, Inc.

NEW YORK, N. Y., Warehouse, Jersey City

BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

"SIMMONS"

LATHES

1—16 in. x 6 ft. Pratt-Whitney Precision Tool Room, taper and draw-in.
1—22 in. x 12 ft. Niles Lathe, complete.
7—24-in. x 10-ft. American High Duty Geared Head.
1—24-in. x 18-ft. LeBlonde Heavy Duty Engine Lathe.
8—27-in. x 18-ft. LeBlonde Heavy Duty, QCG, with motor.
7—27-in. x 24-ft. LeBlonde Heavy Duty, DBG, QCG, (NEW)
4—30-in. x 12-ft. High Duty American Geared Head, motor drive with motor.
1—36-in. x 14-ft. Putnam All Geared Head Lathe.
1—36-in. x 18-ft. Putnam Heavy Duty Triple Geared Lathe.
6—36-in. x 34-ft. Bridgeford Geared Head, QCG, (NEW).
1—42-in. x 20-ft. Niles-Bement-Pond Heavy Duty Triple Geared.
8—48-in. x 29-ft.-56-ft. Niles-Bement-Pond Motor Drive (NEW).
3—60-in. x 29-ft.-56-ft. Niles-Bement-Pond Motor Drive (NEW).

PLANERS

1—60-in. x 60-in. x 20-ft. Woodward-Powell, 4 heads, 35 hp. Motor Rev.
1—48 in. x 48-in. x 20-ft. Ridgeway, high duty, four heads.
1—48-in. x 48-in. x 28-ft. Cincinnati, two heads (NEW).
1—42-in. x 42-in. x 12-ft. Openside Simmons Planer, two heads (NEW).
1—36-in. x 36-in. x 20-ft. Woodward-Powell Planer, four heads.
1—30-in. x 30-in. x 18-ft. Cincinnati, two heads.
1—30 in. x 30 in. x 8 ft. Cincinnati one head.
24 in. x 24 in. x 12 ft. American two heads.

MILLERS

1—No. 1½ Milwaukee Universal Miller, latest type.
8—No. 3-S Cincinnati Geared Head Universal.
5—No. 3 Cincinnati Heavy Duty Geared Head Vertical.
1—No. 4 Cincinnati High Duty Vertical.
1—Pratt-Whitney Heavy Duty Slab Miller.
1—Type-B Gooley-Edlund High Duty "Briggs" Miller.

BORING MILLS

1—12-ft. Bement Extra Heavy Boring-Turning Mill, two swivel heads.
1—10 ft. Betts Vertical Mill, 15 hp. var. speed motor.
1—34-in. Bertram Vertical Turret Head Boring Mill.
1—No. 31 Lucas Precision Horizontal Mill.
1—36-in. Bullard New Era Type Vertical, Cutting Lub. System.
1—24-in. Bullard New Era Type Turret Lathe.

RADIALS

2—6-ft. Reed-Prentice Plain Radial Drill, one with tapping attachment.
1—5-ft. Fosdick Full Universal Radial.
1—4 ft. Prentice Plain.
1—4 ft. Gang Plain Radial.
1—31 in. Rockford Sliding Head Drill Tapping Attachment.
3—No. 310 Baker Heavy Duty Drills, 2½ in. Cap. in steel.
1—28 in. Cincinnati Upright Vertical, tapping attachment.
1—36 in. Aurora Sliding Head Drill.
No. 13 Natco Multiple Spindle Drill.

MISCELLANEOUS

1—48 in. Ohl's Gang Punch.
1—New 5-Ton Pawling & Harnischfeger Crane, 38 ft. span.
1—250 ton Southwark Hydraulic Press.
1—72 in. Niagara Squaring Shear.
1—No. 6 Leffler Inclinable Power Press.
1—14-in. x 96-in. Norton Plain Grinder (NEW).
1—15-18 in. Dill Slotter.
6—32 in. Cincinnati High Duty Shapers (NEW).
2—36 in. Fellows Gear Shapers.
3—Pratt-Whitney No. 12 Two Spindle Profilers.
1—26 in. x 10 ft. Bullard Turret Lathe.
1—Brown-Sharpe Planer Type Surface Grinder.
1—Gould & Eberhardt Spur and Bevel Automatic Gear Cutter.

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SIMMONS MACHINE CO., Albany, N. Y.

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86-88 Exchange St., Buffalo, N. Y.

EXCEPTIONAL VALUES

New and Used Machine Tools of the Better Kind

MILLING MACHINES

1—No. 5 Cincinnati Universal; rectangular arm; latest type.
1—No. 5 Cincinnati Plain; rectangular arm; latest type.
1—No. 3H LeBlond Universal.
1—No. 3B Milwaukee Plain.
1—No. 2 Rockford Universal.
1—No. 2 Cincinnati Universal.
1—No. 2 Kempsmith Universal.
1—NEW No. 1 Kempsmith Universal.
1—NEW No. 1½ Valley City Universal.
ALSO 250 Hand Millers, such as Whitney, etc. Manufacturing Millers, such as Pratt & Whitney, Hendey No. 4.

BORING MILLS—HORIZONTAL AND VERTICAL

1—4-in. Bar Dietrick & Harvey Hor., floor type; latest model.
1—No. 0 Giddings & Lewis Hor.
1—No. 3-A Universal Hor.; 3-bar.
1—No. 2 Rockford Boring Machine.
1—34-in. King Ver. Turret.
1—30-in. Rogers & Hemphill Ver.; 2 heads; belt drive.
1—48-in. Gisholt 2-head Vert.; S. P. D.
1—42-in. New Era Bullard Ver.
1—42-in. Bausch Ver.; 2 heads; belt drive.
1—72-in. Niles Ver.; 2 swivel heads; 6-step cone drive.

RADIAL DRILLS

1—4-ft. Reed-Prentice Plain, S. P. D.
1—4-ft. Western Plain, S. P. D.
1—5-ft. Bickford Plain, S. P. D.
1—6 ft. Baush Plain; cone pulley drive.
1—6-ft. Reed-Prentice Plain, S. P. D.
1—5-ft. Niles-Bement-Pond Semi-Universal, S.P.D.
1—6-ft. Bickford Universal, S. P. D.

PLANERS

3—48 in. x 48 in. x 12 ft. Putnam—2 heads.
1—48 in. x 48 in. x 30 ft. Putnam—4 heads; belt drive.
1—26 in. x 26 in. x 10 ft. Putnam—2 heads; belt drive.
6—NEW 26 in. x 26 in. x 8 ft. Putnam—2 heads; belt drive.
1—30 x 30 x 8 Gray—1 head; belt drive.

GRINDERS

1—NEW 14 x 84 Queen City plain, self-contained.
1—10 x 96 Norton plain, self-contained.
6—10 x 36 Norton plain; ceiling drive.
3—6 x 32 Norton plain; ceiling drive.
12—10 x 36 Cincinnati No. 2—plain.
4—12 x 36 Landis self-contained.
1—No. 11 Brown & Sharpe plain.
20—No. 1 Wilmarth & Morman surface.
1—Springfield-Brandes Horizontal face grinder, 10 x 60 table.
12—NEW No. 20 Bryant chucking.

LATHES

2—14 x 6 Cincinnati QCG CR.
1—New 12 x 5 Davis close coupled tool room—oil pan, taper attachment.
10—NEW 16 x 6 Greaves-Klusman semi-QCG; complete with standard equipment.
10—NEW 18 x 8 Greaves-Klusman heavy duty DBG QCG complete standard equipment.
2—24 x 14 Boye & Emmes QCG DBG.
2—26 x 14 Walcott QCG DBG.
8—18 x 8 Cincinnati standard heavy duty QCG DBG CR and taper att.
3—20 x 12 Greaves-Klusman QCG CR.
3—NEW 24 x 10 Ryerson, QCG CR hollow spindle, belt drive 3-step.
2—30 x 30 American geared head standard screw cutting; 2 carriages.
6—42 x 32 Bridgeford heavy duty standard screw cutting, all geared head, 2 carriages.
1—8 x 84 Lo-Swing; 3 carriages.
1—30 x 10 Hendey Yoke Head, relieving att.
1—20 x 12 Lodge & Shipley QCG, CR, also turret.

TURRET LATHES AND SCREW MACHINES

12—No. 1B Foster Universal, geared head type.
4—No. 2-A Warner & Swasey Universal, S.P.D.
8—No. 3-A Warner & Swasey Universal, S.P.D.
20—3 x 36 Jones & Lamson, geared feed; latest model.
10—24 in. Gisholt turret on carriage—standard machine without chuck, carriage slide and taper attachment; NEW.
8—3¼ x 26 Greenlee rigid type flat, 3-step cone drive.
40—No. 6-A Model 2 Potter & Johnston Manufacturing Automatic Chucking, with 4 and 5 hole turrets.
25—NEW No. 2 Wire feed plain head screw machine, 1⅛ in. cap.
1—No. 6 Warner & Swasey friction back geared, power feed to turret.
5—2¾ in. Gridley 4-spindle Automatic.

This is but a partial list of our stock—write for stock list—we have more than a thousand new and used machines on hand.

MOREY AND COMPANY, INC.
Broome and Lafayette Sts.
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For Sale by **NILES-BEMENT-POND CO., 111 Broadway, New York**

SECOND-HAND MACHINERY

Located at Our Various Factories and Stores

PLANERS AND SHAPERS

14 in. and 20 in. G. & E. Shapers
20 in. Stockbridge Shaper
24 in. x 24 in. x 6 ft. Powell
24 in. x 24 in. x 6 ft., 8 ft. and 10 ft. Whitcomb
26 in. x 26 in. x 6 ft. Gray
30 in. x 30 in. x 6 ft. and 10 ft. Ponds 2 Hds.
30 in. x 30 in. x 12 ft. Pond Reversing Motor
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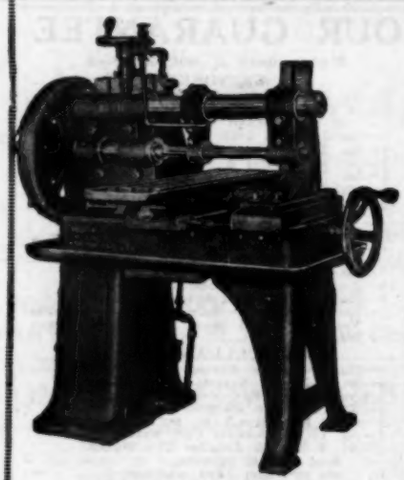

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1—Str. rod draw bench, about 20,000-lb. pull cap.

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20 in. and 24 in. quick-change heavy duty

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POSITIONS WANTED

POSITIONS VACANT

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SCIENCE AND TECHNOLOGY

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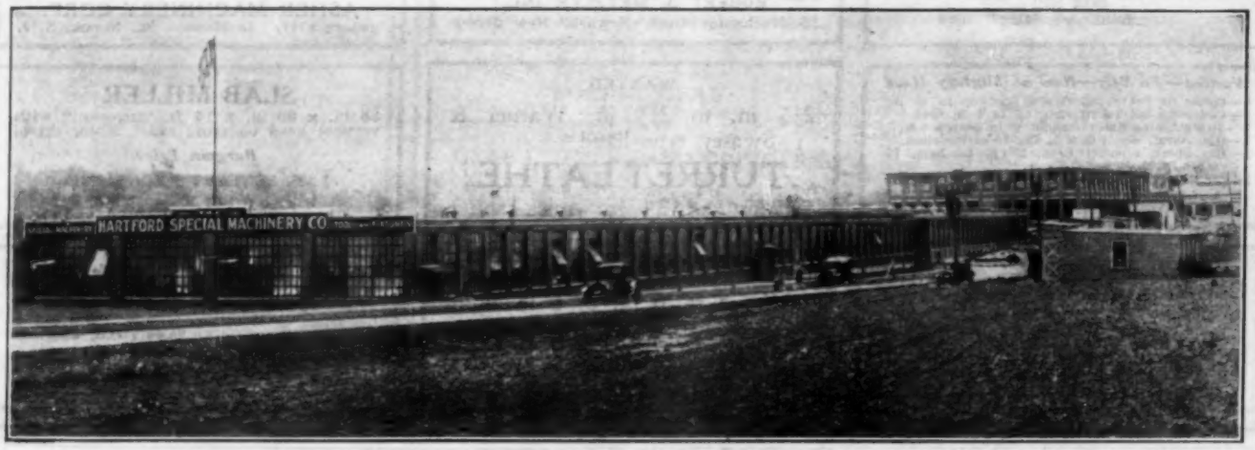

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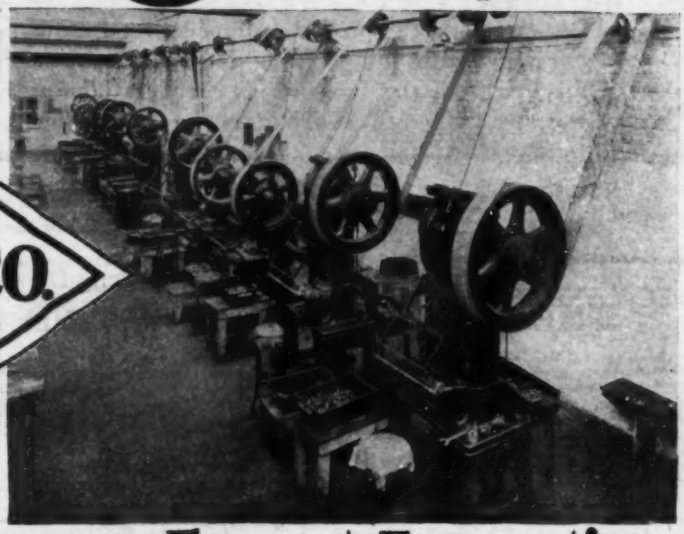

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Builders of the Binghamton Centering Machine and General Machine Work.
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Anything up to 3¼-in. in diameter.

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For Alphabetical Index See Last Page

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Carborundum Co., Niagara Falls
Gardner Mch. Co., Beloit

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Gardner Mch. Co., Beloit
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

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Elmes Eng. Wks., Chas. F., Chicago
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National Twist D. & T. Co., Detroit
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Union Mfg. Co., New Britain.
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford.

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Bearings Co. of America, Lancaster

Balls, Brass, Bronze and Steel
Abbott Ball Co., Hartford.
Auburn Ball Bearing Co., Rochester.
Gwilliam Co., N. Y. C.
SKF Industries, N. Y.

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Globe Mch. & Stamp Co., Cleveland
Royersford Fdry. & Mch. Co., Royersford

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Gisholt Mch. Co., Madison
Marvin & Casler Co., Canastota
Underwood Corp., H. B., Philadelphia

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Bunting Brass & Bronze Co., Toledo.

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Auburn Ball Bearing Co., Rochester.
Bearings Co. of America, Lancaster
Boston Gear Works, Quincy
Fafnir Bearing Co., New Britain.
Gwilliam & Co., N. Y.
Norma Co., of America, N. Y.
Schatz Mfg. Co., Poughkeepsie.
SKF Industries, N. Y.

Bearings, Bronze
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo.
Doehler Die Casting Co., Brooklyn.

Bearings, Die-Cast
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.
Light Mfg. & Fdry. Co., Pottstown.

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American Bronze Corp., Berwyn
Bunting Brass & Bronze Co., Toledo.
Columbus Brass Co., Columbus.

Bearings, Roller
Gwilliam Co., N. Y.
Norma Co. of America, N. Y.
Royersford Fdry. & Mch. Co., Royersford.

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Schieren Co., Chas. A., N. Y.

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Schieren Co., Chas. A., N. Y.
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Belting, Leather
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Manufacturing Equip. & Eng. Co., Framingham.

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Niles-Bement-Pond Co., N. Y.

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Blocks, Chain (See Hoists, Hand)

Blocks, Gage
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Moline Tool Co., Moline
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Knight Mchy. Co., W. B., St. Louis
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Davis Boring Tool Co., St. Louis
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Davis Boring Tool Co., St. Louis
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Newton Mach. Tool Wks., Phila.
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Driver-Harris Co., Harrison

Boxes, Tote (See Furniture, Machine Shop)

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Bridgeport Brass Co., Bridgeport

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Union Mfg. Co., New Britain
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Cushman Chuck Co., Hartford.
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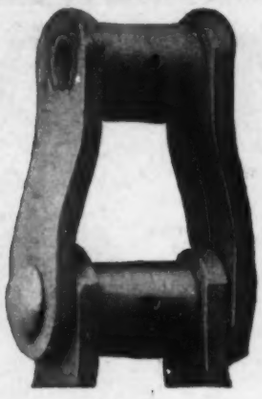
Terkelsen Mch. Co., Boston
Union Mfg. Co., New Britain.
Whiton Mch. Co., D. E., New Londor

Chucks, Magnetic
Heald Machine Co., Worcester.

Chucks, Planer
Cincinnati Planer Co., Cincinnati.
Hoggson & Pettis Mfg. Co., New Haven



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Insure the continuous working of your Elevating, Conveying and Power Transmission Machinery, by keeping spare parts constantly on hand.

Be prepared for increased business by having all your equipment up to its most efficient working order.

Replace that bucket or chain now—make that extension to your plant that you have been thinking about—now!

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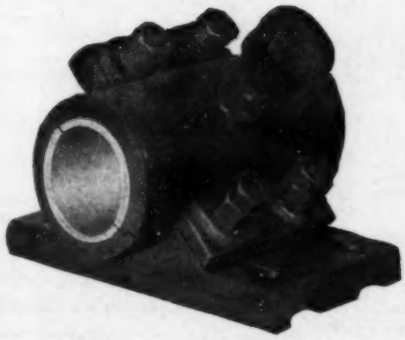
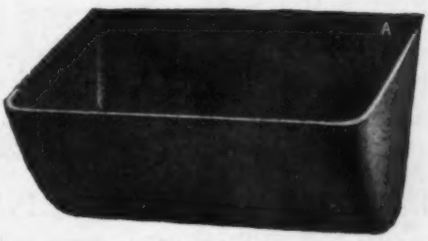
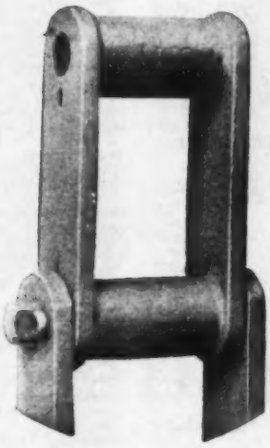
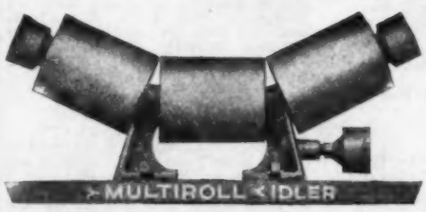
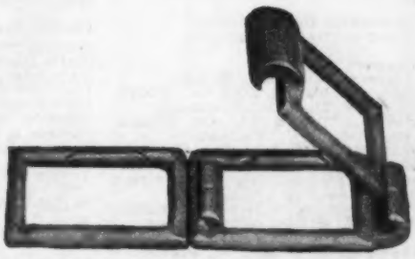










LINK-BELT

Horton & Son Co., E., Windsor Locks
Skinner Chuck Co., New Britain.
Union Mfg. Co., New Britain.

Chucks, Split
Ames Co., B. C., Waltham, Mass.
Rivett Lathe & Grinder Co., Boston.
Seneca Falls Mfg. Co., Seneca Falls.
Stark T. Co., Waltham
Wade-American T. Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport.
Gisholt Mch. Co., Madison

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago.
Reed Mfg. Co., Erie, Pa.
Starrett Co., L. S., Athol, Mass.
Williams & Co., J. H., Brooklyn.

Cleaners, Metal, Waste General
Oakley Chemical Co., N. Y.

Clocks, Time
Gisholt Mch. Co., Madison

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Engrg. Co., Reading, Pa.
Edgemont Mch. Co., Dayton
Hilliard Clutch & Mchy. Co., Elmira
Johnson Mach. Co., Carlyle, Manchester.
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia.

Coal and Ash Handling Machinery
Link-Belt Co., Chicago, Phila.
Shepard Elec. C. & H. Co., Montour Falls.

Coal-Storage Systems
Link-Belt Co., Chicago, Philadelphia

Coils, Electric
General Elect. Co., Schenectady

Collars, Shaft & Set
Royersford Fdry. & Mch. Co., Royersford

Collars, Spacing
Detroit Stamp. Co., Detroit.

Collets
Brown & Sharpe Mfg. Co., Providence.
Geometric Tool Co., New Haven
McCrosky Tool Corp., Meadville
Modern Tool Co., Erie, Pa.
Rivett Lathe & Grinder Co., Boston.
Standard Eng. Wks., Pawtucket.
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford.

Compounds, Carburizing, Casehardening and Tempering
Rogers & Hubbard Co., Middletown
Shore Instrument & Mfg. Co., N. Y.

Compounds, Cleaning
Oakley Chemical Co., N. Y.

Compounds, Cutting, Drawing, Drilling, Grinding and Screw Cutting
Oakley Chemical Co., N. Y.
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester.

Compressors, Air and Gas
Bury Compressor Co., Erie.
Chicago Pneumatic Tool Co., N. Y.
Curtis Pneu. Mchy. Co., St. Louis
General Elect. Co., Schenectady
Ingersoll-Rand Co., N. Y.
Sullivan Machinery Co., Chicago.

Conduits, Interior
General Elec. Co., Schenectady

Containers, Heat Treating
Driver-Harris Co., Harirson

Contract Work
Acklin Stamping Co., Toledo.
American Mch. & Fdry Co., B'klyn.
American Tool Co., Pawtucket
American Tool & Mfg. Co., Urbana.
Ames Co., B. C., Waltham
Barth Stamp & Mch. Wks, Cleveland
Becker Milling Mch. Co., Hyde Park
Bettcher Stamp & Mfg. Co., Cleveland
Betts Mach. Co., Rochester.
Binghamton Mch. Wks., Binghamton
Brock T. & Mfg. Wks., Arthur, Phila.
Brown & Sharpe Mfg. Co., Providence
Buffalo Pitts Co., Buffalo.
Columbus Die T. & M. Co. Columbus
Couradson Mch. T. Co., Green Bay
Davis-Bournonville Co., Jersey City.
Detroit Stamping Co., Detroit
Earle Gear & Mch. Co., Philadelphia.
Emery, A. H., Glenbrook, Conn.
Franklin Mach. Co., Providence.
Garvin Mach. Co., N. Y.
General Mach. Wks, York.
General Rlwy. Signal Co., Rochester
Gisholt Mch. Co., Madison
Grant Mfg. & Mach. Co., Bridgeport
Hartford Special Mchy. Co., Hartford
Keller Mech. Eng., Brooklyn.
Kempsmith Mfg. Co., Milwaukee
Lamb Co., Jos. T., Detroit
Lambert & Todd Mach. Co., Camden,
Lincoln Mach. Co., Pawtucket.
Long and Allstatter Co., Hamilton
Lux Clock Mfg. Co., Waterbury
Mehl Mach. Tool & Die Co., Roselle.
Meisel Press Mfg. Co., Boston.
New London Ship & Eng. Co., Groton
Robbins Mch. Wks., Worcester
Root Co., B. M., York
Rowbottom Mach. Co., Waterbury
Sexton Mch. Co., Hartford
Shepard Eng. Co., Williamsport
Simplex Tool Co., Woonsocket
Starrett Co., L. S., Athol
Steel Prod. Eng. Co., Springfield
Sterling Specialty Co., Newcomerstown
Terkel-en Mch. Co., Boston
Toledo Mch. & Tool Co., Toledo
Underwood Corp., H. B., Phila.
Wade-American T. Co., Waltham
Waltham Mach. Wks., Waltham

Controllers & Starters
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Converters
General Elect. Co., Schenectady

Conveyors and Elevators (See Elevators)

Cotter Pins
Williams & Co., J. H., Brooklyn

Counterbores
Detroit Twist Drill Co., Detroit
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit

Countershafts
Brown & Sharpe Mfg. Co., Providence.
Diamond Mach. Co., Providence.
Evans Fric. Cone Co., Newton Highlands.
Garvin Mach. Co., N. Y.

Counters, Revolution
Bristol Co., Waterbury.

Counting Machines
Hart Mfg. Co., R. A., Battle Creek.

Counting and Printing Wheels
Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.

Couplings, Flexible
Brown Eng. Co., Reading
Smith and Serrell, Newark.

Coupling Hose, Universal
Chicago Pneu. Tool Co., N. Y.

Couplings, Rigid
Smith & Serrell, N. Y.

Couplings, Shaft
Almond, T. R., Mfg. Co., Ashburnham
Edgemont Mch. Co., Dayton
Johnson Mach. Co., Carlyle, Manchester.
Nicholson & Co., W. H., Wilkes-Barre
Royersford Fdry. & Mach. Co., Royersford
Smith and Serrell, Newark, N. J.
Standard Gauge Steel Co., Beaver Falls

Cranes, Electric (See Hoists & Cranes, Electric)

Cranes, Hand (See Hoists, Hand)

Cranes, Locomotive
Link-Belt Co., Chicago, Philadelphia

Cranes, Traveling
Canton Fdry. & Mach. Co., Canton.
Curtis Pneu. Mchy. Co., St. Louis
Harrington, Son & Co., Ed., Phila.
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Engrg. Wks., Detroit.
Pawling & Harnischfeger, Milwaukee
Shepard Elec. C. & H. Co., Montour Falls.
Toledo Crane Co., Bucyrus

Crank Pin Turning Machines
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Cut-outs, Electrical
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Cutters, Gear
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Cutters, Milling
Barber-Colman Co., Rockford, Ill.
Becker Milling Mach. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence.
Cowles Tool Co., Cleveland.
Detroit Twist Drill Co., Detroit
Geometric Tool Co., New Haven.
Ingersoll Milling Mch. Co., Rockford
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.
Whitney Mfg. Co., Hartford.

Cutters, Thread.
Rivett Lathe & Grinder Co., Boston.
Universal Mch. Co., Bowling Green

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Automatic Mach. Co., Bridgeport.
Brown & Sharpe Mfg. Co., Providence.
Cochrane-Bly Co., Rochester
Earle Gear & Mach. Co., Phila.
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine.
Hurlbut-Rogers Mchy. Co., So Sudbury
Newton Mach. Tool Wks., Phila.
Vandyck Churchill Co., N. Y.
Williams & Co., J. H., Brooklyn

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago.

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxy-Acetylene
Davis-Bournonville Co., Jersey City.

Dealers, Machinery (See Searchlight Section)
Asher Mchy. Co., Newark
Bath Co., Cyril J., Cleveland
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence.
Easley, E. L., Mchy. Co., Chicago
Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Hill, Clarke & Co. of Chicago.
Hyman & Sons, Jas., Philadelphia
Ideal Mchy. Co., Plainsville
Industrial Plants Corp., N. Y.
Lamberg & Co., A., N. Y.
McMullen Mchy. Co., Grand Rapids
Metzler, Robt. J., Newark
Morey & Co., N. Y.
N. J. Mchy. Exch., Newark
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Osborne Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Purinton & Smith, Hartford
Russell Mch. Co., Pittsburgh
Ryerson & Son, Joseph T., Chicago
Seyfert's Sons, L. F., Philadelphia
Sherritt & Stoer Co., Philadelphia
Simmons Mach. Co., N. Y.
Standard Machy. Co., New Haven
Stokvis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck Churchill Co., N. Y.
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

Diamond Tools
Crafts & Co., Arthur A., Boston.
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit.

Die Making Machines
Cochrane-Bly Co., Rochester
Keller Mech. Engraving Co., Bklyn.

Dies, Forging
Keller Mech. Engraving Co., Bklyn.
Steel Prod. Eng. Co., Springfield

Dies, Self-Opening Adjustable
Eastern Mach. S. Corp., New Haven.
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Murchey Mch. & T. C., Detroit
Victor Tool Co., Waynesboro

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mach. S. Corp., New Haven.
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Mch. & T. C., Detroit
National Acme Co., Cleveland.
National Mchy. Co., Tiffin, Ohio.
Steel Prod. Eng. Co., Springfield
Victor Tool Co., Waynesboro

Dividing Heads
Knight Mchy. Co., W. B., St. Louis

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago.

Drafting Boards and Tables
Pease Co., C. F., Chicago

Drafting Materials
Pease Co., C. F., Chicago

Dressers, Grinding Wheel
Bay State Stamping Co., Worcester.
Clemson Bros., Inc., Middletown
Crafts & Co., Arthur A., Boston.
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago.

Drill Speeders
Graham Mfg. Co., Providence.
Turner Mach. Co., Danbury.

Drilling Attachments
Hjorth Lathe & T. Co., Boston.

Drilling Machine Heads
Baush Mch. T. Co., Springfield, Mass.
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
Nelson-Blanck Mfg. Co., Detroit.

Drilling Machines, Automatic
Avey Drilling Mach. Co., Cincinnati.
Baker Bros., Toledo, O.
Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Arlington
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Bench
Ames Co., B. C., Waltham, Mass.
Avey Drill. Mach. Co., Cincinnati.
Barnes Co., W. F. & John, Rockford.
Clark Elect. Co., Jas., Louisville.
Clemson Bros., Inc., Middletown
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinnati
Taylor & Fenn Co., Hartford.
U. S. Elec. Tool Co., Cincinnati

Drilling Machines, Duplex
Knight Mchy. Co., W. B., St. Louis

Drilling Machines, Electric and Pneumatic
Chicago Pneumatic Tool Co., N. Y.
Clark Elect. Co., Jas., Louisville.
Ingersoll-Rand Co., N. Y.
Louisville Elect. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinnati
U. S. Elec. Tool Co., Cincinnati.

Drilling Machines, Gang
Baker Bros., Toledo.
Barnes Drill Co., Rockford, Ill.
Cincinnati (O.) Bickford Tool Co.
Colburn Mach. Tool Co., Cleveland
Dreses Mch. T. Co., Cincinnati
Foote-Burt Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Arlington
Moline Tool Co., Moline, Ill.
Silver Mfg. Co., Salem
Sipp Mach. Co., Paterson.
Taylor & Fenn Co., Hartford.

Drilling Machines, Heavy Duty
Baker Bros., Toledo.
Betts Mach. Co., Rochester.
Colburn Mach. Tool Co., Cleveland
Foote-Burt Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Hoefer Mfg. Co., Freeport
Minster Mch. Co., Minster
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

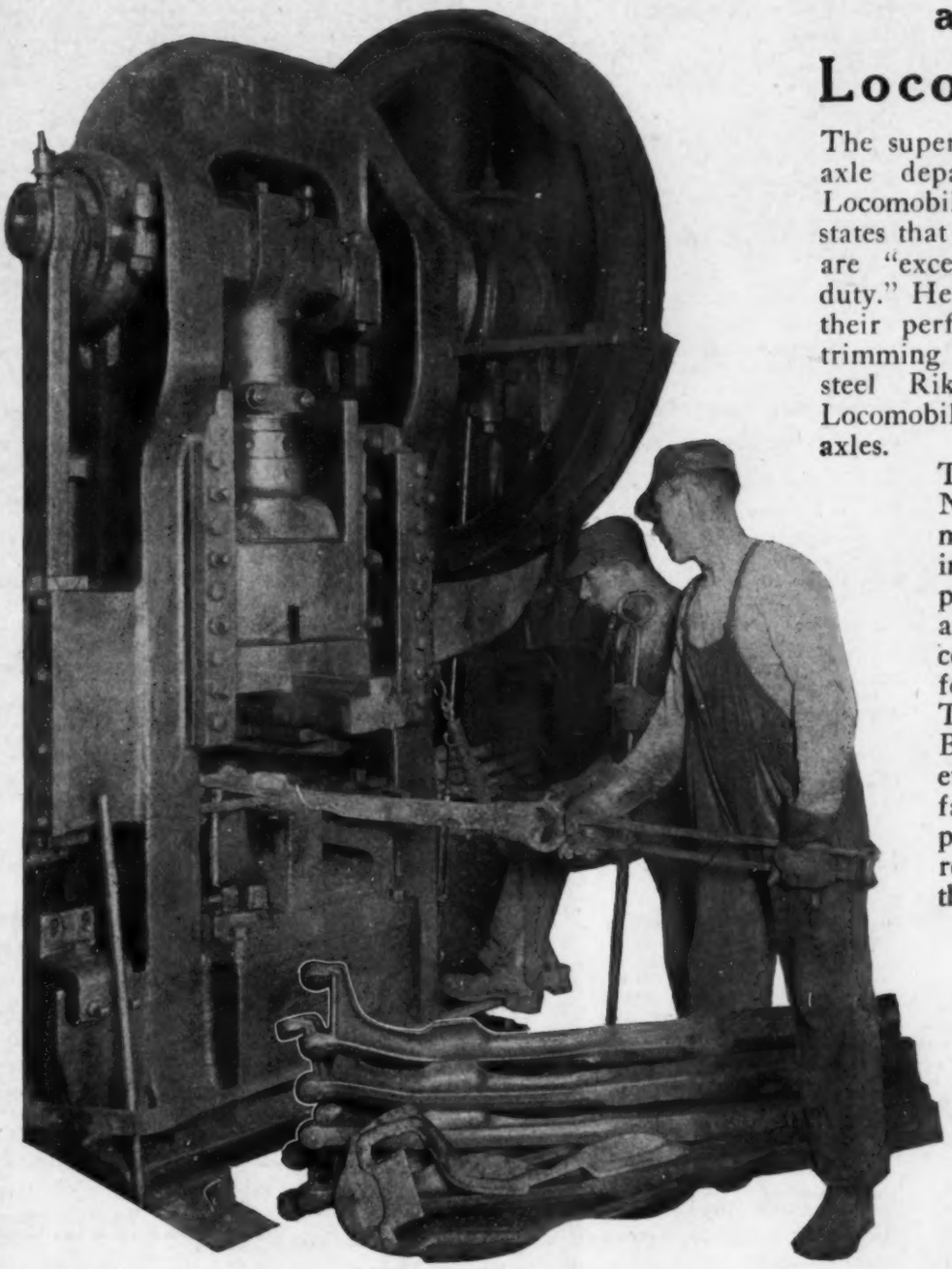
Drilling Machines, Multiple Spindle
Baush Mch. T. Co., Springfield, Mass.
Foote-Burt Co., Cleveland
Fox Machine Co., Jackson, Mich.
Harrington Son & Co., Ed., Phila.
Langelier Mfg. Co., Arlington
National Acme Co., Cleveland
Nat'l Automatic Tool Co., Richmond
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Philadelphia.
Turner Machine Co., Danbury.

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mach. Co., Rochester.
Cincinnati (O.) Bickford Tool Co.
Fosdick Mach. Tool Co., Cincinnati.
Harrington Son & Co., Ed., Phila.
Henry & Wright Mfg. Co., Hartford
Lynd-Farquhar Co., Boston.
Morris Mach. Tool Co., Cincinnati.
Mueller Mach. Tool Co., Cincinnati.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia.

Drilling Machines, Sensitive
Avey Drill. Mach. Co., Cincinnati.
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Arlington

BANKING ON BLISS

at the Locomobile



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E. W. Bliss Co.

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American Factories: BROOKLYN, N. Y., HASTINGS, MICH., CLEVELAND, O., SALEM, O.

BLISS 1921

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NEW HAVEN, 2nd Nat'l Bank Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURGH, Keenan Bldg.

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Leland-Gifford Co., Worcester.
Reed-Prentice Co., Worcester.
Royersford Fdry. & Mach. Co., Royersford
Sup Mach. Co., Paterson.
Taylor & Fenn Co., Hartford.

Drilling Machines, Turret
Nat'l Automatic Tool Co., Richmond
Turner Mach. Co., Danbury.

Drilling Machines, Vertical
Avey Drill. Mach. Co., Cincinnati.
Baker Bros., Toledo.
Barnes Co., W. F. & John, Rockford.
Barnes Drill Co., Rockford, Ill.
Baush Mch. T. Co., Springfield, Mass.
Betts Mach. Co., Rochester.
Cincinnati (O.) Bickford Tool Co.
Colburn Mach. Tool Co., Cleveland
Foote-Burt Co., Cleveland
Fosdick Mch. T. Co., Cincinnati
Harrington Son & Co., Ed., Phila.
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Knight Mchy. Co., W. B. St. Louis.
Langelier Mfg. Co., Arlington
Leland-Gifford Co., Worcester.
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester.
Royersford Fdry. & Mach. Co., Royersford
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford.
Turner Mach. Co., Danbury.

Drills, Center
Detroit Twist Drill Co., Detroit
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
Detroit Twist Drill Co., Detroit
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.

Drills, Twist and Flat
Buckeye Twist Drill Co., Alliance.
Detroit Twist Drill Co., Detroit
Fast-Feed Drill & T. Corp., Toledo
Latrobe Tool Co., Latrobe.
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Akron

Dynamometers
General Elect. Co., Schenectady

Electrical Instruments
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Electrical Supplies
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Elevating Trucks (See Trucks)
Elevators and Conveyors
Caldwell & Son Co., H. W., Chicago
Link-Belt Co., Chicago, Philadelphia

Emery Wheels (See Grinding Wheels)

Engines, Oil, Gas and Steam
Chicago Pneu. Tool Co., N. Y.

Engineers, Industrial & Mechanical
Hartford Special Mchy. Co., Hartford
Underwood Corp., H. B., Phila.

Engraving Machinery
Gorton Mach. Co., Geo., Racine.
Keller Mech. Engraving Co., Bklyn.

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglasses, Safety (See Goggles, Safety)

Fans, Electric
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Exhaust
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans Ventilating
General Elect. Co., Schenectady

File Handles
Nicholson File Co., Providence.

Files and Rasps
American Swiss F. & T. Co., N. Y.
Barnett Co., G. & H., Philadelphia.
Nicholson File Co., Providence.

Filing Machines
Ames Co., B. C., Waltham, Mass.
Cochrane-Bly Co., Rochester
Noble & Westbrook Mfg. Co., Hartford.
Oliver Instrument Co., Adrian.

Filler, Iron (See Cements, Iron)

Fittings, Hydraulic
Burroughs Composition Mchy. Corp., Newark.
Elmes Eng. Wks., Chas. F., Chicago.
Watson-Stillman Co., N. Y.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago
Errington Mechanical Laboratory, N. Y.
Strand & Co., N. A., Chicago.

Forgings, Drop
Bearings Co. of America, Lancaster
Universal Mch. Co., Bowling Green
Williams Co., J. H., Brooklyn

Forging Machinery
Acme Mchy. Co., Cleveland.
Bradley & Son, C. C., Syracuse.
National Mchy. Co., Tiffin.

Foundry Equipment
Adams Co., Dubuque, Ia.

Fuel Oil Buring System
Advance Furnace & Eng. Co., Springfield, Mass.

Furnaces, Forging
Bellevue Industrial Furnace Co., Detroit.
Chicago Flexible Shaft Co., Chicago.

Furnaces, Heat-Treating, Coal
American Industrial Furnace Corp., Boston

Furnaces, Heat Treating, Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., N. Y.
American Industrial Furnace Corp., Boston
Bellevue Industrial Furnace Co., Detroit.
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
Johnson Gas Appliance Co., Cedar Rapids

Furnaces and Ovens, Electric
Englehard, Charles, N. Y.
General Elect. Co., Schenectady

Furnaces, Tempering and Annealing
Advance Furnace & Eng. Co., Springfield, Mass.
Bennett Co., W. R., Elmwood, Ct.
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
General Elect. Co., Schenectady
Johnson Gas Appliance Co., Cedar Rapids

Furniture, Machine Shop
Brown Eng. Co., Reading
Manufacturing Equip. & Eng. Co., Framingham.

Gages, Comparator
Jones & Lamson Mch. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence
Niles-Bement-Pond Co., N. Y.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Hartford Special Mchy. Co., Hartford

Gas, Compressed
Davis-Bournonville Co., Jersey City

Gear Cutting Machines
Adams Co., Dubuque.
Barber-Coleman Co., Rockford, Ill.
Becker Milling Mch. Co., Hyde Park.
Bilgram Machine Works, Phila.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cutting Mch. Co
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Garvin Mach. Co., N. Y.
Gleason Works, Rochester
Gould & Eberhardt, Newark
Harrington Son & Co., Ed., Phila.
Newark Gear Cutting M. Co., Newark
Newton Mach. Tool Works, Phila.
Waltham Mach. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mch. Co., Madison
Gleason Works, Rochester
Newark Gear Cut Mch. Co., Newark

Gears, Cast
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Caldwell & Son Co., H. W., Chicago
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland.
Link-Belt Co., Chicago, Philadelphia
Meisel Press Mfg. Co., Boston
Philadelphia Gear Works, Phila.

Gears, Cut
Adams Co., Dubuque
Albaugh-Dover Co., Chicago
Baush Mch. T. Co., Springfield, Mass.
Bilgram Machine Works, Phila.
Boston Gear Wks., Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Chicago Rawhide Mfg. Co., Chicago
Cincinnati Gear Co., Cincinnati
Connecticut Gears, Inc., Waterbury
Diefendorf Gear Corp., Syracuse.
Earle Gear & Mch. Co., Philadelphia
Fawcus Machine Co., Pittsburgh.
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Foote Bros. Gear & M. Co., Chicago.
Garvin Mach. Co., N. Y
General Elect. Co., Schenectady
Gleason Works, Rochester
Grant Gear Works, Boston.
Horsburgh & Scott Co., Cleveland
Link-Belt Co., Chicago, Philadelphia
M-C Mfg. Co., Newark
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
Newark Gear Cutting Mach. Co., Newark.
Niles-Bement-Pond Co., N. Y.
Philadelphia Gear Works, Phila.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Philadelphia Gear Wks., Philadelphia

Generators, Electric
General Electric Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Grab Buckets
Link-Belt Co., Chicago, Philadelphia
Toledo Crane Co., Bucyrus

Greases, Lubricating
Royersford Fdry. & Mach. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Mch. & Fdry. Co., Athol
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Clark Elec. Co., Jas., Louisville.
Diamond Mach. Co., Providence
Louisville Elect. Mfg. Co., Louisville
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Safety Emery Wheel Co., Springfield, O.
Standard Elect. T. Co., Cincinnati
Union Twist Drill Co., Athol
U. S. Electrical Tool Co., Cincinnati

Grinding Machines, Center
Louisville Elect. Mfg. Co., Louisville
Standard Elect. T. Co., Cincinnati
U. S. Electrical Tool Co., Cincinnati

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mach. Co., Cambridge
Bryant Chuck Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barnes Co., W. F. & John, Rockford.
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cut. Mch. Co.
Cincinnati (O.) Milling Mach. Co.
Diamond Mach. Co., Providence
Garvin Mach. Co., N. Y.
Gisholt Mch. Co., Madison
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mach. Tool Co., R. K., Cincinnati
Modern Tool Co., Erie, Pa.
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
U. S. Electrical Tool Co., Cincinnati
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck Grinder Co., Springfield, Vt.
Detroit Mch. Tool Co., Detroit
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Norton Co., Worcester
Rivett Lathe & Grinder Co., Boston
Sanford Mfg. Co., F. C., Bridgeport
Van Norman Mch. Tool Co., Springfield, Mass.
Whitney & Son, Baxter D., Winchendon
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Die
Bignall & Keeler Mach. Co., Edwardsville.
Blanchard Mach. Co., Cambridge
Diamond Mach. Co., Providence
Geometric Tool Co., New Haven
Heald Machine Co., Worcester
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland.
National Machinery Co., Tiffin
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Wilmarth & Morman Co., Grand Rapids.

Grinding Machines, Disc
Badger Tool Co., Beloit
Besly & Co., Chas. H., Chicago
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit
Louisville Elect. Mfg. Co., Louisville
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin, O.
U. S. Electrical Tool Co., Cincinnati
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Face
Blanchard Mach. Co., Cambridge
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Forbes & Myers, Worcester
Louisville Elect. Mfg. Co., Louisville
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Royersford Fdry. & Mach. Co., Royersford
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin, O.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Gage
Landis Tool Co., Waynesboro, Pa.
Rivett Lathe & Grinder Co. Boston
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Internal
Bryant Chuck Grinder Co., Springfield, Vt.
Garvin Mach. Co., N. Y.
Heald Mach. Co., Worcester
Landis Tool Co. Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mch. Tool Co., Springfield, Mass.
Whitney & Son, Baxter D., Winchendon
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Chicago Pneumatic Tool Co., N. Y.
Clark Elec. Co., Jas., Louisville.

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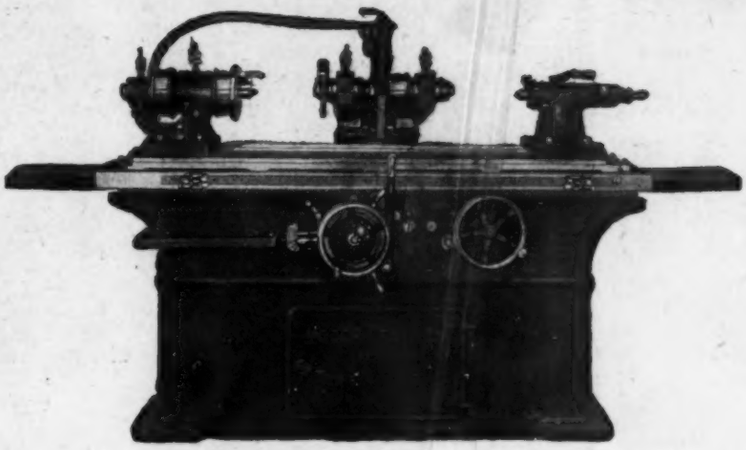
MODERN

Universal Grinding Machines



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It's a great servant in repair and contract shops.

In construction it is on a par with the Modern Plain Grinding Machines which are known for their reliability and production records.

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Louisville Elect. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Stroud, Arva, N. Y.
U. S. Electrical Tool Co., Cincinnati

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Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Ring Wheel
Badger Tool Co., Beloit
Besly & Co., Chas. H., Chicago
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mach. Co., Providence
Ransom Mfg. Co., Oshkosh

Grinding Machines, Surface
Blanchard Mach. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Detroit Mch. Tool Co., Detroit
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co., Worcester
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Norton Co., Worcester
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
Wilmarth & Morman Co., Grand Rapids

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Chicago Pneumatic Tool Co., N. Y.
Gisholt Mch. Co., Madison
Landis Tool Co., Waynesboro
Norton Co., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Wheels
Carborundum Co., Niagara Falls.
Dickinson, Thomas L., N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin.
Vitrified Wheel Co., Westfield

Guides, Elevator
Standard Gauge Steel Co., Beaver Falls

Gun-Barrel Machinery
Baush Mch. T. Co. ,Springfield, Mass.

Hammers, Drop
Bradley & Son, C. C., Syracuse.
Niles-Bement-Pond Co., N. Y.

Hammers, Forging
Nazel Eng. & Mch. Wks., Philadelphia

Hammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.
Ingersoll Rand Co., N. Y.

Hammers, Power
Bliss Co., E. W., Brooklyn.
Bradley & Son, C. C. Syracuse.
Nazel Eng. & Mach. Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago
West Tire Setter Co., Rochester.

Handles, Machine
Rockwood Sprinkler Co., Worcester

Hangers, Shafting
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence.
Royersford Fdry. & Mach. Co., Royersford
S K F Industries, N. Y.

Hardening, Casehardening and Tempering
General Machine Works, York, Pa.

Hardness Testing Apparatus
Shore Instrument & Mfg. Co., N. Y.

Hobbing Machines
Adams Co., Dubuque.
Barber-Colman Co., Rockford, Ill.
Cincinnati (O) Gear Cut. Mch. Co.
Gould & Eberhardt, Newark
M-C Mfg. Co., Newark, N. J.
Newark Gear Cut Mch. Co., Newark

Hobs
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland.
Newark Gear Cut Mch. Co., Newark
Simmons Method-Hob Co., Phila.
Union Twist Drill Co., Athol.

Hoists & Cranes, Electric
Link-Belt Co., Chicago, Philadelphia
Niles-Bement-Pond Co., N. Y.
Northern Eng. Works, Detroit.
Pawling & Harnischfeger Co., Milwaukee
Shepard Elec. C. & H. Co., Montour Falls.
Toledo Crane Co., Bucyrus
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Hoists, Hand
Canton F. & M. Co., Canton.
Ford Chain Block & Mfg. Co., Phila.
Harrington Son & Co., Ed., Phila.

Hoists, Pneumatic
Chicago Pneumatic Tool Co., N. Y.
Curtis Pneu. Mchy. Co., St. Louis
Ingersoll-Rand Co., N. Y.
Sullivan Mchy Co., Chicago

Holders-On, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Hydraulic Leather
Schieren Co., Chas A., N. Y.

Hydraulic Machinery
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Igniters, Gas Engine
Dochler Die Casting Co., Brooklyn.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence.
Marvin & Casler Co., Canastota
Starrett Co., L. S., Athol.

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago.

Jigs and Fixtures (See Contract Work)

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence.
Gray & Prior Mach. Co., Hartford.
Manufacturing Equip. & Eng. Co., Farmingham.

Keyseating Machines
Baker Bros., Toledo
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson.
Mitts & Merrill, Saginaw.
Morton Mfg. Co., Muskegon Heights.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.

Keys, Machine
Moltrup Steel Products Co., Beaver Falls
Morton Mfg. Co., Muskegon Heights.
Whitney Mfg. Co., Hartford.

Knurl Holders
Williams & Co., J. H., Brooklyn.

Lamp Brackets, Adjustable
McCrosky Tool Corp., Meadville

Lamps, Electric
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Lathe Attachments
Ames Co., B. C., Waltham, Mass.
Dalton Mfg. Corp., N. Y.
Flather & Co., Nashua
Rivett Lathe & Grinder Co., Boston

Lathe Tools
Armstrong Bros. Tool Co., Chicago
Gisholt Mch. Co., Madison
Williams & Co., J. H., Brooklyn

Lathes, Automatic and Semi-Automatic
Gisholt Mch. Co., Madison
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket.
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison.

Lathes, Bench
Ames Co., B. C., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Dalton Mfg. Co., N. Y.
Diamond Machine Co., Providence
Hjorth Lathe & T. Co., Boston.
Johnston Mfg. Co., Arlington
Potter Tool & Mch. Wks., N. Y.
Rivett Lathe & Grinder Co., Boston
Seneca Falls Mfg. Co., Seneca Falls.
South Bend Lathe Wks., South Bend.
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.
Wade-American T. Co., Waltham

Lathes, Boring
Gisholt Mch. Co., Madison
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket.

Lathes, Chucking (See Lathes, Hurizontal Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati.
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
Blount Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cincinnati
Champion Tool Wks. Co., Cincinnati.
Dalton Mfg. Corp., N. Y.
Fitchburg Mach. Wks., Fitchburg
Flather & Co., Nashua
Gisholt Mch. Co., Madison
Greaves, Klusman T. Co., Cincinnati
Hamilton Mch. Tool Co., Hamilton
Hendey Mach. Co., Torrington
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Mach. Tool Co., Sidney, O.
Morris Mach. Tool Co., Cincinnati
Mueller Mach. Tool Co., Cincinnati
Niles-Bement-Pond Co., N. Y.
Reed-Prentice Co., Worcester
Robbins Mch. Wks., Worcester
Rockford (Ill.) Tool Co.
Ryerson & Son, Joseph T., Chicago
Seneca Falls Mfg. Co., Seneca Falls
Sidney Mch. Tool Co., Sidney
South Bend Lathe Wks., South Bend
Springfield Mch. T. Co., Springfield, O.
Whitcomb-Blaisdell M. T. Co., Worcester
Wickes Bros., Saginaw

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Barnes Drill Co., Rockford, Ill.
Harrington Son & Co., Ed., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford,
Dalton Mfg. Corp., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Horizontal Turret
Acme Mach. Tool Co., Cincinnati
Foster Mach. Co., Elkhart
Gisholt Mch. Co., Madison
International Mach. Tool Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
Millholland Mch. Co., Indianapolis
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison

Lathes, Polishing (See Polishing and Buffing)

Lathes, Speed and Hand
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Diamond Machine Co., Providence
Flather Mfg. Co., Nashua
Garvin Mach. Co., N. Y.
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Threading
Automatic Mach. Co., Bridgeport
Flather Mfg. Co., Nashua
Rivett Lathe & Grinder Co., Boston

Lathes, Vertical Turret
Bullard Mach. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford.
Blount Co., J. B., Everett.
Seneca Falls Mfg. Co., Seneca Falls

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven
Pannier Bros. Stamp Co., Pittsburgh

Lighting Fixtures
General Elect. Co., Schenectady
McCrosky Tool Corp., Meadville

Lockers, Clothes
Manufacturers Equip. & Eng. Co., Framingham.

Lubricants
Oakley Chemical Co., N. Y.
Royersford Fdry. & Mach. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago.
Athol Mch. & Fdry. Co., Athol
Browne & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Simplex Tool Co., Woonsocket
Starrett Co., L. S., Athol.
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Brown & Sharpe Mfg. Co., Providence.
Cochrane-Bly Co., Rochester
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence.
Nicholson & Co., W. H., Wilkes-Barre
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Marking Machines
Noble & Westbrook Mfg Co., Hartford.

Marking Devices (See Stamps, Steel)

Metal Cleaning Equipment
Pangborn Corp., Hagerstown, Md.

Meters, Steam Flow
General Elect. Co., Schenectady
Norma Co. of America, N. Y.

Micrometer Calipers
Almond Mfg. Co., T. R., Ashburnham
Brown & Sharpe Mfg. Co., Providence.
Randall & Stickney, Waltham
Starrett Co., L. S., Athol.

Milling Attachments
Adams Co., Dubuque.
Becker Milling Mch. Co., Hype Park.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Milling Mach. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee.
LeBlond Mach. Tool Co., R. K., Cincinnati.
Potter & Johnston Mach. Co., Pawtucket
Standard Eng. Wks., Pawtucket.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Milling Mach. Co.
Ingersoll Mill Mch. Co., Rockford

Milling Machines Bench
Ames Co., B. C., Waltham.
Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co., Winsted
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Ingersoll Mill Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Potter & Johnston Mch. Co., Pawtucket

Milling Machines, Duplex
Cincinnati (O.) Milling Mach. Co.
Knight Mchy. Co., W. B., St. Louis.
Newton Mach. Tool Wks., Phila.

Milling Machines, Hand
Becker Milling Mch. Co., Hyde Park.
Brown & Sharpe Mfg. Co., Providence
Burke Mch. T. Co., Conneaut
Carter & Hakes Mach. Co., Winsted.
Cincinnati (O.) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Standard Eng. Wks., Pawtucket.
Van Norman Mach. Tool Co., Springfield, Mass.
Whitney Mfg. Co., Hartford.

Milling Machines, Horizontal and Planer Type
Beaman & Smith Co., Providence
Betts Mach. Co., Rochester.
Ingersoll Milling Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.

Milling Machines, Plain
Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester
Browne & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. Tool Co., R. K., Cincinnati
Newton Mach. Tool Wks., Phila.
Potter & Johnston Mach. Co., Pawtucket
Ryerson & Son, Joseph T., Chicago
Standard Eng. Wks., Pawtucket
Van Norman Mch. Tool Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Mill Mch. Co., Rockford
Newton Mach. Tool Wks., Phila.
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Automatic Mach. Co., Bridgeport
Foster Mach. Co., Elkhart
Gisholt Mch. Co., Madison
Hall Planetary Thread Milling Mch. Co., Philadelphia
Harrington Son & Co., Ed., Phila.
Newton Mach. Tool Wks., Phila.
Waltham Mach. Wks., Waltham

Stewart Vertical Muffle Furnace for High Speed Steel

Furnaces of this type are intended for use where it is necessary that the products of combustion be prevented from coming in contact with the work. Unusually efficient in heat treatment of long pieces apt to be distorted when laid on floor of oven furnace. Especially recommended for hardening reamers, hobs, cutters, drills and similar articles.

Furnace is circular—gas or oil fired. Carbofrax muffle in center, with small openings around bottom to admit reducing gases preventing scaling of work. Pieces are suspended in rectangular opening at top—do not touch each other or walls of muffle.

Three Standard Sizes

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When a manufacturer selects Stewart Furnaces for his heat treating operations, he is assured of heat treating economy.

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Stewart Furnaces are built to master the most intricate heat treating jobs in your plant. They are designed and built by men who know the heat treating requirements of modern industry.

The wide experience of our Service Department in planning heat treating equipment for varied industries should prove helpful in solving your difficulties. This service is freely extended.

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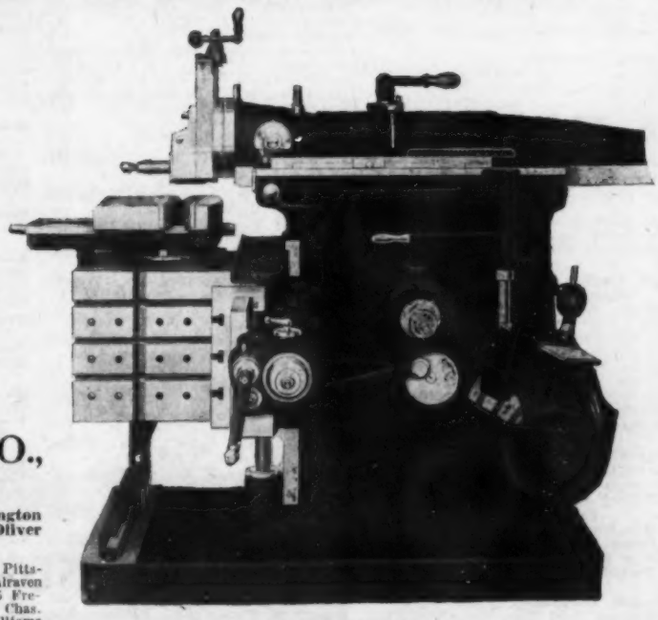

Hendey 20-in. Crank Shaper

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Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Hendey Mach. Co., Torrington
Ingersoll Mill Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mach. T. Co., R. K., Cincinnati
Potter & Johnston Mach. Co., Pawtucket
Ryerson & Son, Joseph T., Chicago
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Becker Milling Mch. Co., Hyde Park.
Betts Mach. Co., Rochester
Brown & Sharpe Mfg. Co., Providence
Burke Mch. T. Co., Conneaut
Cincinnati (O.) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mach. Co., Rockford
Kearney & Trecker Co., Milwaukee
Knight Mchy. Co., W. B., St. Louis
LeBlond Mach. Tool Co., R. K., Cincinnati
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket
Van Norman Mach. T. Co., Springfield, Mass.

Milling Machines, Worm
Cleveland Auto Mach. Co., Cleveland
Newton Mach. Tool Wks., Phila.
Waltham Mach. Wks., Waltham

Milling Tools, Adjustable, Hollow
Geometric Tool Co., New Haven

Monel Metal
Driver-Harris Co., Harrison

Monel Metal Castings
Driver-Harris Co., Walkerville, Ont., Canada

Motors, Electric
Burke Elect. Co., Erie
General Elect. Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Nickel Sheets
Driver-Harris Co., Harrison

Nut Tappers (See Bolt and Nut Machinery)

Oil and Grease Cups
Bay State Stamp Co., Worcester
Bowen Products Corp., Auburn,
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

Oil Stones
Norton Co., Worcester

Oils
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Oxygen
Davis-Bournonville Co., Jersey City

Packing, Hydraulic
Chicago Rawhide Mfg. Co., Chicago
Schieren Co., Chas. A., N. Y.

Pattern Shop Machinery (See Woodworking Machinery)

Patterns, Wood and Metal
Everett Pattern Wks., Everett
Mehl Mach. Tool & Die Co., Roselle

Pipe Bending Machines
Harrington Son & Co., Edwin, Phila.
Underwood Corp., H. B., Phila.

Pipe Cutting and Threading Machines
Bignall & Keeler Mach. Wks., Edwardsville.
Fox Machine Co., Jackson, Mich.
Harrington Son & Co., Edwin, Phila.
Landis Mach. Co., Waynesboro
Merrell Mfg. Co., Toledo
Purchey Mch. & T. Co., Detroit
Saunders Sons, D., Yonkers
Treadwell Eng. Co., Easton

Pipe Fitters' Tools
Butterfield & Co., Derby Line, Vt.
Saunders Sons, D., Yonkers
Williams & Co., J. H., Brooklyn

Piston-Ring Machines
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket

Planing Machines
American Tool Wks. Co., Cincinnati
Betts Machine Co., Rochester
Cincinnati Planer Co., Cincinnati
Cleveland Planer Co., Cleveland
Hamilton Mch. Tool Co., Hamilton
Liberty Mch. Tool Co., Hamilton
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia
Whitcomb-Blaisdell Mch. Tool Co., Worcester

Planing Machines, Rotary
Newton Mch. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Underwood Corp., H. B., Phila.

Plate Rolls
Niles-Bement-Pond Co., N. Y.

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford
Chicago Pneu. Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Mach. Co., Cambridge
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Bryant Church Grinder Co., Springfield, Vt.
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Newton Mach. Tool Wks., Phila.
Noble & Westbrook Mfg. Co., Hartford
Potter Tool & Mach. Wks., N. Y.
Rivett Lathe & Grinder Co., Boston
Rowbottom Mach. Co., Waterbury
Royersford Fdry. & Mach. Co., Royersford
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol
U. S. Elect. Tool Co., Cincinnati
Van Norman Mch. T. Co., Springfield, Mass.

Pressed Steel Parts
Acklin Stamp. Co., Toledo
Worcester Pressed S. Co., Worcester

Presses, Arbor
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Crane Puller Co., Arlington
Nicholson & Co., W. H., Wilkes-Barre

Presses, Broaching
Atlas Press Co., Kalamazoo

Presses, Drop and Forging
Ams Mach. Co., Max N. Y.
Bliss Co., E. W., Brooklyn
Elmes Eng. Wks., Chas. F., Chicago
Niles-Bement-Pond Co., N. Y.
Toledo Mach. & Tool Co., Toledo
U. S. Tool Co., Newark

Presses, Foot and Hand
Atlas Press Co., Kalamazoo
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford

Presses, Forcing
Ams Mach. Co., Max N. Y.
Atlas Press Co., Kalamazoo
Barnes Co., W. F. & John, Rockford
Hydraulic Press Mfg. Co., Mt. Gilead
Lucas Mach. Tool Co., Cleveland

Presses, Hydraulic
Burroughs Composition Mchy Corp., Newark
Elmes Eng. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead
Niles-Bement-Pond Co., N. Y.
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Presses, Power
Ams Mach. Co., Max N. Y.
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Henry & Wright Mfg. Co., Hartford
Rowbottom Mach. Co., Waterbury
Stoll Co., D. H., Buffalo
Toledo Mach. & Tool Co., Toledo
V. & O. Press Co., Glendale, N. Y.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn

Profiling Machines
Becker Milling Mch. Co., Hyde Park.
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
Newton Mach. Tool Wks., Phila.
Stark Tool Co., Waltham
Wade-American T. Co., Waltham

Pullers, Wheel
Crane Puller Co., Arlington

Pulley Turning and Boring Machines
American Tool Wks. Co., Cincinnati
Niles-Bement-Pond Co., N. Y.

Pulleys, Cork Insert
American Pulley Co., Philadelphia

Pulleys Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester.

Pumps, Hydraulic
Burroughs Composition Mchy Corp., Newark
Elmes Eng. Wks., Chas F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Oilgear Co., Milwaukee

Pumps, Power
Ingersoll-Rand Co., N. Y.
Sullivan Mchy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago

Punches, Power
Ferracute Mach. Co., Bridgeton
Mitts & Merrill, Saginaw
Royersford Fdry. & Mach. Co., Royersford
Ryerson & Sons, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury.
Engelhard Chas., N. Y.

Rack Cutting Machines
Gould & Eberhardt, Newark
Newark Gear Cut Mch. Co., Newark

Rack Machine
Standard Gauge Steel Co., Beaver Falls

Racks, Cut
Moltrup Steel Products Co., Beaver Falls

Racks, Storage (See Furniture, Machine Shop)

Radiators, Japanning Oven
American Gas Furnace Co., N. Y.
Chicago Flexible Shaft Co., Chicago.

Rammers, Foundry
Brown & Sharpe Mfg. Co., Providence.
Chicago Pneumatic Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer, Holders
Gisholt Mch. Co., Madison
Victor Tool Co., Waynesboro

Reamers, Expanding
Brubaker & Bros. Co., W. L., N. Y.
Detroit Twist Drill Co., Detroit
Gisholt Mch. Co., Madison
McCrosky Tool Corp., Meadville

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance.
Butterfield & Co., Derby Line, Vt.
Detroit Twist Drill Co., Detroit
Gammon Holman Co., Manchester
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland.
National Twist D. & T. Co., Detroit
Reed Mfg. Co., Erie.
Union Twist Drill Co., Athol.
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Brown & Sharpe Mfg. Co. Providence.
Gammon-Holman Co., Manchester
Union Twist Drill Co., Athol

Recorders, Pressure
Bristol Co., Waterbury.

Recorders, Temperature
Bristol Co., Waterbury.

Recorders, Time
Gisholt Mch. Co., Madison

Resistance Materials
Driver-Harris Co., Harrison, N. J.

Rheostats
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Rivet Making Machinery
Cook Co., Asa S., Hartford.
National Machinery Co., Tiffin.

Rivet Sets
Chicago Pneu. Tool Co., N. Y.

Riveting Machines
Chicago Pneumatic Tool Co., N. Y.
Grant Mfg. & Mach. Co., Bridgeport
Ingersoll-Rand Co., N. Y.
Shuster Co., F. B., New Haven
Townsend Mfg. Co., H. P., Hartford.

Rod Cutters
Tucker, W. A. & C. F., Hartford

Rules, Steel
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.

Rust Preventatives
Oakley Chemical Co., N. Y.

Sand-Blast Apparatus
Pangborn Corp., Hagerstown, Md.

Sand Rammers, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Saw Frames and Blades, Hack
Clemson Bros., Inc., Middletown
Diamond S. & Stamp Wks., Buffalo
Hunter Saw & Mch. Co., Pittsburgh
Napier Saw Wks., Springfield, Mass
Starrett Co., L. S., Athol.
Thompson & Son Co., Hy. G., New Haven.

Saw Sharpening Machines
Cochrane-Bly Co., Rochester

Saw Tables, Universal
Baker Bros., Toledo.
Silver Mfg. Co., Salem

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago.
Cochrane-Bly Co., Rochester
Diamond S. & Stamp Wks., Buffalo
Earle Gear & Machine Co., Phila.
Napier Saw Wks., Springfield, Mass.
Newton Mach. Tool Wks., Phila.
Vandyck Churchill Co., N. Y.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago.
Clemson Bros., Inc., Middletown
Diamond S. & Stamp Wks., Buffalo
Napier Saw Wks., Springfield, Mass.
Thompson & Son Co., Hy. G., New Haven.
Victor Saw Wks., Middletown

Saws, Circular Metal
Barber-Colman Co., Rockford, Ill.
Cochrane-Bly Co., Rochester
Hunter Saw & Mch. Co., Pittsburgh
Napier Saw Wks., Springfield, Mass.
Union Twist Drill Co., Athol.

Saws, Metal Band
Hunter Saw & Mch. Co., Pittsburgh
Silver Mfg. Co., Salem

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence
Cochrane-Bly Co., Rochester
Hunter Saw & Mch. Co., Pittsburgh

Saws, Milling
Brown & Sharpe Mfg. Co., Providence.
National Tool Co., Cleveland
Union Twist Drill Co., Athol

Saws, Screw Slotting
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol.
Union Twist Drill Co., Athol.

Scales
Brown & Sharpe Mfg. Co., Providence.

Screw-Machine Work
Acme Mch. T. Co., Cincinnati
Automatic Products Co., L. I. City
Cincinnati (O.) Automatic Mach. Co.
Eastern Mch. Screw Corp., New Haven
Link-Belt Co., Chicago, Phila.
Meisel Press Mfg. Co., Boston
National Acme, Cleveland.
Poorman, J. E., Philadelphia
Simplex Tool Co., Woonsocket

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford.
Townsend Mfg. Co., H. P., Hartford.

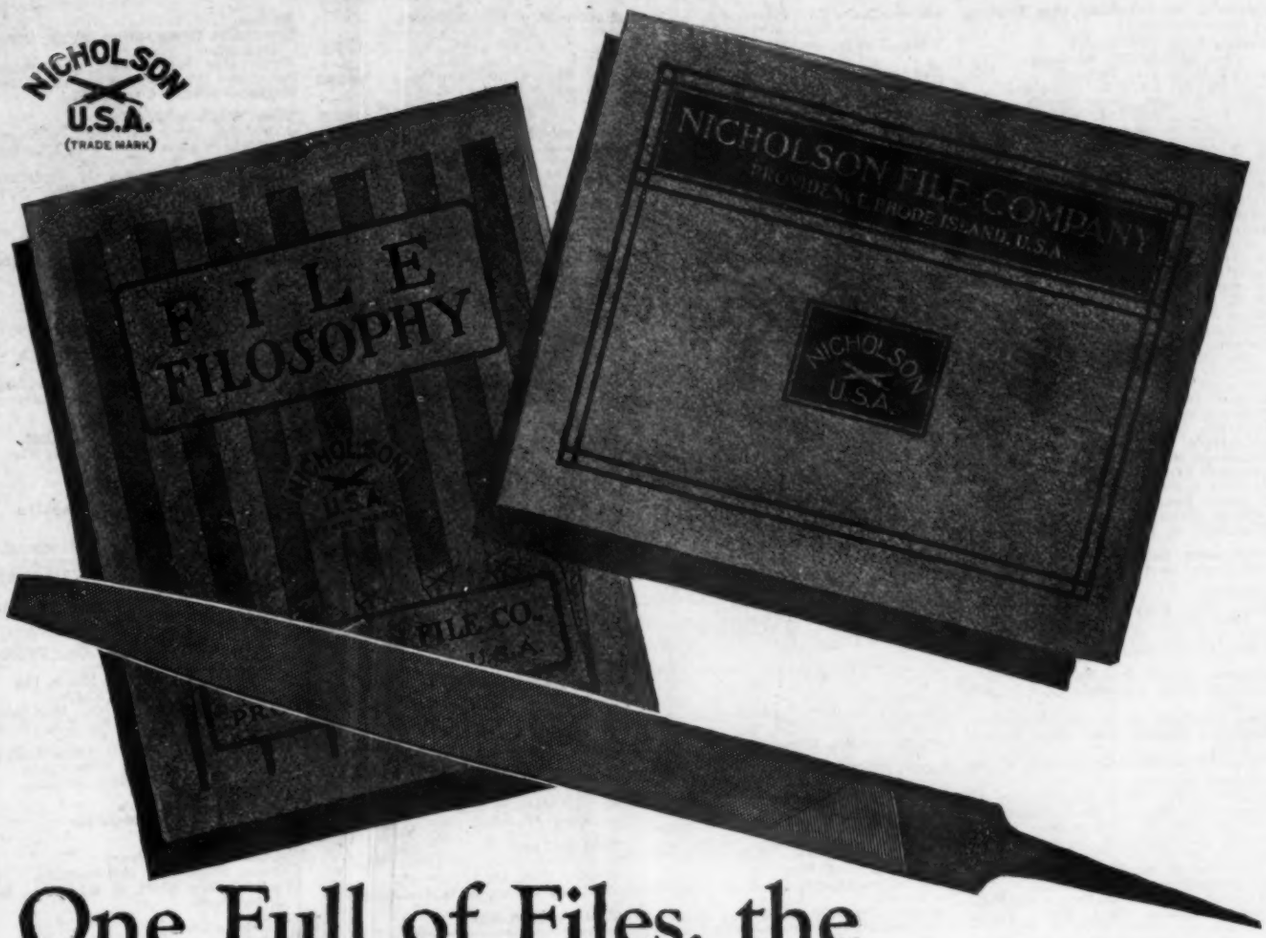
Screw Machines, Automatic
Acme Mch. T. Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence.
Cincinnati (O.) Automatic Mach. Co.
Cleveland (O.) Auto. Mach. Co.
Cone Auto. Mch. Co., Windsor
Davenport Mch. T. Co., Rochester
National Acme Co., Cleveland.

Screw Machines, Plain or Hand
Acme Machine Tool Co., Cincinnati.
Brown & Sharpe Mfg. Co., Providence
Cleveland (O), Auto Mch. Co.
Foster Mach. Co., Elkhart.
Garvin Mach. Co., N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Millholland Mch. Co., Indianapolis.

Screw Plates
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Morse Twist D. & M. Co., New Bedford

Screws, Cap and Set
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.
National Acme Co., Cleveland.

Screws, Machine
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury



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Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery (See Searchlight Section)
Asher Mchy Co., Newark
Bath & Co., Cyril J., Cleveland
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence.
Cincinnati Planer Co., Cincinnati.
Essley, E. L., Mchy. Co., Chicago
Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Hill, Clarke & Co., Chicago.
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Industrial Plants Corp, N. Y.
Lamberg & Co., A., N. Y.
McMullen Mchy. Co., Grand Rapids
Metzler, Robt. J., Newark
Morey & Co., N. Y.
N. J. Mchy. Exch., Newark
Niles & Co., F. H., N. Y.
Niles-Bement-Pond Co., N. Y.
Osborne & Septon Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Purinton & Smith, Hartford
Russell Mach. Co., Pittsburgh
Ryerson & Son, Joseph T., Chicago
Seyfert's Sons, L. F., Philadelphia
Sherritt & Stoer Co., Philadelphia
Simmons Mach. Co., N. Y.
Standard Mchy. Co., New Haven.
Stokvis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Wayne Mchy. Co., Ft. Wayne.
Winterer, H. L., Philadelphia.

Separators, Oil and Waste
Pangborn Corp., Hagerstown, Md.

Shafting
Royersford Fdry. & Mach. Co., Royersford
Strand & Co., N. A., Chicago
Union Drawn Steel Co., Beaver Falls

Shapes, Cold-Drawn Special Steel
Moltrup Steel Products Co., Beaver Falls
New England D. S. Co., Mansfield.
Standard Gauge Steel Co., Beaver Falls
Union Drawn Steel Co., Beaver Falls.

Shaping Machines
American Tool Wks. Co., Cincinnati.
Cincinnati Shaper Co., Cincinnati.
Cochrane-Bly Co., Rochester
Gould & Eberhardt, Newark
Hendey Mach. Co., Torringhon
Kelly Co., R. A., Xenia.
Lynd-Farquhar Co., Boston.
Morton Mfg. Co., Muskegon Heights.
Newton Mach. Tool Wks., Phila.
Niles-Bement-Pond Co., N. Y.
Potter & Johnston Mach. Co., Pawtucket.
Queen City Mch. T. Co., Cincinnati
Ryerson & Son, Joseph T., Chicago
Smith & Mills Co., Cincinnati.
Springfield Mch. T. Co., Springfield, O.
Steel Prod. Eng. Co., Springfield
Whipp Mch. T. Co., Sidney

Shear, Blades
Cleveland (O.) Knife & Forge Co.

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago.
Tucker, W. A. & C. F., Hartford.

Shears, Power
Ferracute Mach. Co., Bridgeton, N. J.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mach. Co., Royersford
Stoll Co., D. H., Buffalo.
Toledo Mach. & Tool Co., Toledo.

Sheet Metal Working Machinery
Ams Mach Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Ryerson & Son, Joseph T., Chicago
Savage Co., W. J., Knoxville.
Toledo Mach. & Tool Co., Toledo.

Shelving Steel
Niles-Bement-Pond Co., N. Y.

Slotting Machines
Betts Mach. Co., Rochester.
Cochrane-Bly Co., Rochester
Garvin Mach. Co., N. Y.
National Acme Co., Cleveland.
Newton Mach. Tool Wks., Phila.
Sellers & Co., Wm., Phila.

Sockets and Sleeves
Detroit Twist Drill Co., Detroit

Special Machinery and Tools (See Contract Work)

Speed Reducers
Philadelphia Gear Wks., Phila.

Spring Winders
Hjorth Lathe & T. Co., Boston.

Springs
Newcomb Spring Corp., Brooklyn

Sprockets and Chains
Baldwin Chain & Mfg. Co., Worcester.
Bilgram Mach. Wks., Phila.
Boston Gear Wks., Quincy.
Fullman Wheel Co., Chicago.
Grant Gear Wks., Boston.
Link-Belt Co., Chicago, Phila.
Meisel Press Mfg. Co., Boston.
Morse Chain Co., Ithaca.
Philadelphia Gear Works, Phila.
Whitney Mfg. Co., Hartford

Squares
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol

Stampings, Metal
Acklin Stamp. Co., Toledo, O.
American Pulley Co., Phila.
Bay State Stamp. Co., Worcester.
Detroit Stamp. Co., Detroit.
Globe Mch. & Stamp Co., Cleveland
Worcester Pressed S. Co., Worcester

Stamps, Steel
Hoggson & Pettis Mfg. Co., New Haven.
Noble & Westbrook Mfg. Co., Hartford.
Pannier Bros. Stamp Co., Pittsburgh
Schwerdtle Stamp Co., Bridgeport

Stands, Portable (See Furniture, Machine Shop)

Steam Specialties
Dart Mfg. Co., E. M., Providence.

Steel, Cold Rolled Strip
Driver-Harris Co., Harrison
Hawkridge Bros. Co., Boston.

Steel Hardness Measuring and Treating Instruments
Shore Instrument & Mfg. Co., N. Y.

Steel Shafting and Free Cutting Screw
Hawkridge Bros. Co., Boston.
Moltrup Steel Products Co., Beaver Falls
New England D. Steel Co., Mansfield
Standard Gauge Steel Co., Beaver Falls.
Union Drawn Steel Co., Beaver Falls.

Steel, Sheet
Colonial Steel Co., Pittsburgh
Hawkridge Bros. Co., Boston.
Jessop & Sons, Wm., N. Y.

Steels, Alloy Carbon, and High Speed
Armstrong Bros. Tool Co., Chicago.
Buffalo Forge Co., Buffalo.
Colonial Steel Co., Pittsburgh
Firth-Sterling Steel Co., McKeesport
Hawkridge Bros. Co., Boston.
Haynes Stellite Co., Kokomo
Jessop & Sons, Wm., N. Y.
Vanadium-Alloys Steel Co., Pittsburgh.
Vulcan Crucible Steel Co., Aliquippa

Stellite
Haynes Stellite Co., Kokomo

Stools, Shop
Manufacturing Equip. & Eng. Co., Framingham.

Straightening Machinery
Shuster Co., F. B., New Haven.
Springfield Mch. T. Co., Springfield, O.
Standard Eng. Wks., Pawtucket.

Stud Setters, Opening
Errington Mechanical Laboratory, N. Y.

Subpresses and Dies
Waltham Mach. Wks., Waltham.

Surface Plates
Simplex Tool Co., Woonsocket

Swaging Machines
Langlier Mfg. Co., Arlington
Torrington Co., Torrington

Switches and Switchbacks
General Elec. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Tachometers
Bristol Co., Waterbury.

Tap Extensions
Allen Mfg. Co., Hartford.

Tap Holders
Apex Mach. Co., Dayton
Errington Mechanical Laboratory, N. Y.
Gisholt Mch. Co., Madison

Taper Pins
Brown & Sharpe Mfg. Co., Providence.

Tapes, Measuring
Starrett Co., L. S., Athol.

Tapping Machines and Attachments
Acme Machinery Co., Cleveland.
American Tool Wks. Co., Cincinnati
Baker Bros., Toledo
Beaman & Smith Co., Providence
Burke Mch. T. Co., Conneaut
Cincinnati (O.) Bickford Tool Co.
Errington Mechanical Laboratory, N. Y.
Fox Machine Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Geomtric Tool Co., New Haven, Ct.
Harrington Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Arlington
McCrosky Tool Corp., Meadville, Pa.
Moline Tool Co., Moline
Nat'l Automatic Tool Co., Richmond
National Machinery Co., Tiffin
Turner Machine Co., Danbury

Taps and Dies
American Tap & Drill Co., Greenfield
Brubaker & Bros Co., W. L., N. Y.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield.
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland

Taps, Collapsing
Eastern Mach. Screw Corp., New Haven.
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven, Ct.
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland.
Victor Tool Co., Waynesboro

Thermometers
Bristol Co., Waterbury, Conn.
Englehard, Charles, N. Y.

Thread-Cutting Tools
Eastern Mach. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro
Modern Tool Co., Erie
Murchey Mch. & T. Co., Detroit
National Acme Co., Cleveland.
Rivett Lathe & Grinder Co., Boston
Victor Tool Co., Waynesboro

Threading Machines
Automatic Mach. Co., Bridgeport
Eastern Mach. Screw Corp., New Haven
Geometric Tool Co., New Haven
Hall Planetary Thread Mill Mch. Co., Philadelphia
Landis Mach. Co., Waynesboro
National Acme Co., Cleveland
National Machinery Co., Tiffin.
Universal Mech. Co., Bowling Green

Thread Rolling Machines
National Machinery Co., Tiffin.

Tool Holders
Armstrong Bros. Tool Co., Chicago
Gisholt Mch. Co., Madison
Williams & Co., J. H., Brooklyn

Tool Posts, Lathe
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

Tool Work (See Contract Work)

Tools, Small (See Machinists' Small Tools)

Torches, Blow
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Tractors, Industrial
Elwell-Parker Elec. Co., Cleveland

Transformers
Foote Bros. Gear & Mch. Co., Chicago.
General Elect. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Transmission Machinery
Foote Bros. Gear & Mch. Co., Chicago.
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia.
Morse Chain Co., Ithaca
Oilgear Co., Milwaukee
Royersford Fdry. & Mach. Co., Royersford

Transportation Systems (See Trucks)

Trolleys and Tramways
Curtis Pneu. Mchy. Co., St. Louis
Harrington Son & Co., Edwin, Phila.
Shepard Elec. C. & H. Co., Montour Falls.

Trucks
Lewis-Shepard Co., Boston

Trucks, Industrial Motor
Elwell Parker Elec. Co., Cleveland

Tubing, Flexible
Almond Mfg. Co., T. R., Ashburnham

Turret Heads
Almond Mfg. Co., T. R., Ashburnham

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post
American Tool Wks. Co., Cincinnati

Unions, Pipe
Dart Mfg. Co., E. M., Providence

Universal Joints
Apex Mach. Co., Dayton
Baush Mch. T. Co., Springfield, Mass.
Boston Gear Works, Quincy
Gray & Prior Mach. Co., Hartford
Universal Mch. Co., Bowling Green

Valves
Burroughs Composition Mchy. Corp. Newark
Elmes Eng. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead
Watson-Stillman Co., N. Y.

Vises, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Brown Eng. Co., Reading
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven.

Vises, Metal Workers'
Athol Mach. & Fdry. Co., Athol
Hartford Special Mchy. Co., Hartford
Parker Co., Chas., Meriden
Reed Mfg. Co., Erie

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Hartford Special Mchy. Co., Hartford
Standard Eng. Wks., Pawtucket

Vises, Pipe
Athol Mach. & Fdry. Co., Athol
Butterfield & Co., Derby Line, Vt.
Parker Co., Chas., Meriden
Reed Mfg. Co., Erie, Pa.
Saunders Sons, D., Yonkers
Williams & Co., J. H., Brooklyn

Vises Planer and Shaper
American Tool Wks. Co., Cincinnati
Cincinnati Planer Co., Cincinnati
Hartford Special Mchy. Co., Hartford
Hendey Mach. Co., Torrington
Hoggson & Pettis Mfg. Co., New Haven.

Vises, Universal Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Graham Mfg. Co., Providence
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven.
Horton & Son Co., E., Windsor Locks
Kempsmith Mfg. Co., Milwaukee
Skinner Chuck Co., New Britain.

Vises, Wood Workers
Parker Co., Chas., Meriden

Voltmeters
Bristol Co., Waterbury
General Elec. Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Wagon Loaders
Link-Belt Co., Chicago, Philadelphia

Wash Stands and Bowls
Manufacturing Equip. & Eng. Co., Framingham.

Washers
Detroit Stamp Co., Detroit

Welding, Electric
(See Welding Machines, Electric)

Welding, Oxy-Acetylene
(See Welding Machines Oxy-Acetylene)

Welding Machines, Electric
Federal Mch. & Welder Co., Warren
General Elec. Co., Schenectady
Thomson Elec. Welding Co., Lynn.
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Welding Machines, Oxy-Acetylene
Imperial Brass Mfg. Co., Chicago

Wire
Driver-Harris Co., Harrison.
Gwilliam Co., N. Y.
Hawkridge Bros. Co., Boston

Wire, Electric
Simplex Wire & Cable Co., Boston

Wire Straightening and Cutting Machinery
Rowbottom Mach. Co., Waterbury
Shuster Co., F. B., New Haven

Woodruff Keys
Standard Gauge Steel Co., Beaver Falls

Wood-Working Machinery
Blount Co., J. G., Everett
Greaves, Klusman T. Co., Cincinnati
Rowbottom Mach. Co., Waterbury
Seneca Falls Mfg. Co., Seneca Falls
Silver Mfg. Co., Salem

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

Wrenches, Machinist
Williams & Co., J. H., Brooklyn

Wrenches, Pipe
Williams & Co., J. H., Brooklyn

Wrenches, Ratchet
Pratt & Whitney Co., Hartford
Starrett Co., L. S., Athol

Wrenches, Tap
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield
Starrett Co., L. S., Athol

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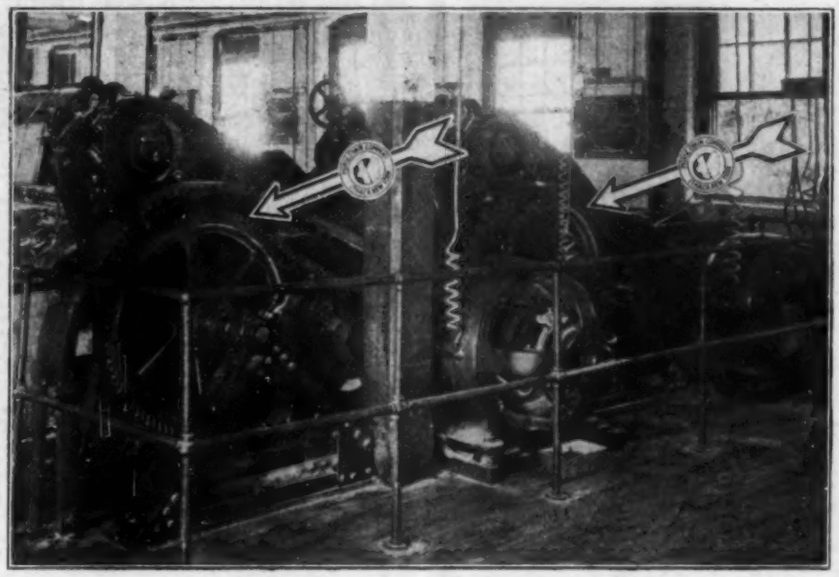

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ALPHABETICAL INDEX TO ADVERTISERS

	Page
Abbott Ball Co.	102
Accurate Brass Casting Co.	89
Acklin Stamping Co.	131
Acme Machine Tool Co.	46
Acme Machinery Co.	105
Adams Co.	74
Advance Furnace & Engineering Co.	88
Albaugh-Dover Co.	90
Allen Mfg. Co.	108
Almond Mfg. Co., T. R.	106
American Bronze Corp.	4th Cover
American Equipment Co.	106
American Gas Furnace Co.	88
American Industrial Furnace Corporation	88
American Mach. & Foundry Co.	121
American Pulley Co.	94
American Swiss File & Tool Co.	112
American Tap & Die Co.	108
American Tool & Mfg. Co.	122
American Tool Works Co.	14, 15
Ames Co., B. C.	100
Ams Machine Co., Max	103
Anderson Bros. Mfg. Co.	84
Apex Machine Co.	111
Armstrong Blum Mfg. Co.	104
Armstrong Bros. Tool Co.	110
Asher Machy Co.	119
Athol Machine & Foundry Co.	71
Atlas Press Co.	103
Auburn Ball Bearing Co.	81
Automatic Products Corp.	123
Automatic Machine Co.	73

	Page
Badger Tool Co.	94
Baker Bros.	96
Baldwin Chain & Mfg. Co.	84
Barber-Colman Co.	24
Barnes Co., W. F. & John	33
Barnes Drill Co.	97
Barnett Co., G. & H.	64
Barrett Machine Tool Co.	58
Barth Stamp & Mch. Wks.	122
Bath, Cyril J.	114
Baush Machine Tool Co.	42
Bay State Stamping Co.	101
Beaman & Smith Co.	102
Bearings Co. of America	81
Becker Milling Machine Co.	52
Bellevue Industrial Furnace Co.	94
Besly Co., Chas. H.	94
Best Furnace & Burner Corp., W. N.	88
Bettcher Stamping & Mfg. Co.	121
Betts Machine Co.	9
Bickford & Co., H.	73
Bignall & Keeler Machine Works	10
Bilgram Machine Works	74
Binghamton Machine Works	122
Blanchard Machine Co.	55
Bliss Co., E. W.	127
Blount Co., J. G.	95
Boston Gear Works	93
Botwinik Bros.	118
Bowen Products Corp.	101
Bradford Machine Tool Co.	598
Bradley & Son, C. C.	103
Bridgeport Brass Co.	70
Bristol Co.	4th Cover
Brock, Jr., Tool & Mfg. Wks., Arthur	121
Brown Co., A. & F.	84
Brown Engineering Co.	86
Brown & Sharpe Mfg. Co.	66, 67
Brownell Machinery Co.	118
Brubaker & Bros., Co., W. L.	47
Bryant Chucking Grinder Co.	195
Buckeye Twist Drill Co.	62
Buffalo Forge Co.	102
Buffalo-Pitts Co.	121
Bullard Machine Tool Co.	22
Bunting Brass & Bronze Co.	86
Burke Elec. Co.	75
Burke Machine Tool Co.	73
Burroughs Composition Mach. Corp.	80
Bury Compressor Co.	80
Butterfield & Co.	111

	Page
Caldwell & Son Co., H. W.	83
Canton Foundry & Machine Co.	84
Carborundum Co.	36, 37
Card Mfg. Co., S. W.	25
Carter & Hakes Machine Co.	72
Champion Tool Works Co.	100
Chicago Flexible Shaft Co.	122, 131
Chicago Pneumatic Tool Co.	79
Chicago Rawhide Mfg. Co.	92
Cincinnati Auto Mach. Co.	72
Cincinnati Bickford Tool Co.	10
Cincinnati Gear Co.	93
Cincinnati Gear Cutting Mch. Co.	74
Cincinnati Milling Machine Co.	6
Cincinnati Planer Co.	46
Cincinnati Shaper Co.	74
Clark Electric Co., Jas., Jr.	75
Clemson Bros., Inc.	105
Cleveland Automatic Machine Co., 26, 27	
Cleveland Knife & Forge Co.	102
Cleveland Planer Co.	74
Cochrane Bly Co.	73
Colburn Machine Tool Co.	49
Colonial Steel Co.	86
Columbus Brass Co.	122
Columbus Die Tool & Mach. Co.	123
Cone Automatic Machine Co.	74
Connecticut Gears, Inc.	92
Conradson Machine Tool Co.	121
Contract Work	120
Cook Co., Asa S.	74
Cowles Tool Co.	108
Crafts & Co. Arthur A.	64
Crane Puller Co.	83
Cullman Wheel Co.	84
Curtis Pneumatic Machinery Co.	89
Cushman Chuck Co.	107

	Page
Dalton Manufacturing Corp.	44, 99
Dart Mfg. Co., E. M.	112
Davenport Machine Tool Co.	73
Davis-Bournonville Co.	83
Detroit Machine Tool Co.	56
Detroit Stamping Co.	73
Detroit Twist Drill Co.	109
Diamond Machine Co.	94
Diamond Saw & Stamping Works	106
Dickinson, Thos. L.	64
Diefendorf Gear Corp.	93
Doehler Die Casting Co.	89
Driver-Harris Co.	7

	Page
Earle Gear & Mach. Co.	93, 104
Eastern Machine Screw Corp.	92
Edgemont Machine Co.	82
Elmes Engr. Works, Chas. F.	80
Elwell Parker Electric Co.	64
Emery, A. H.	121
Engelhard, Chas.	108
Errington Mechanical Laboratory	107
Easley Mchy. Co., E. L.	117
Evans Friction Cone Co.	83
Everett Pattern Works	121

	Page
Fafnir Bearing Co.	81
Fastfeed Drill & Tool Corp.	108
Fawcus Machine Co.	92
Federal Machine & Welder Co.	86
Fellows Gear Shaper Co.	16, 17
Ferracute Machine Co.	102
Firth-Sterling Steel Co.	86
Fitchburg Machine Works	63
Flather & Co.	19
Foote Bros. Gear & Mach. Co.	90
Foote Burt Co.	96
For Sale	113
Forbes & Myers	80
Ford Chain Block Co.	82
Fosdick Machine Tool Co.	50
Foster Machine Co.	42
Fox Machine Co.	101
Franklin Die Casting Corp.	89
Franklin Machine Co.	122
Frontier Chuck & Tool Co.	106

	Page
Gammons-Holman Co.	110
Gardner Machine Co.	94
Garvin Machine Co.	106
Geib Co., J.	116
General Electric Co.	76
General Machine Works	123
Geometric Tool Co.	11
Gisholt Machine Co.	99
Gits Bros. Mfg. Co.	101
Gleason Works	85
Globe Machine & Stamping Co.	123
Gorton Machine Co., Geo.	101
Gould & Eberhardt	74
Graham Mfg. Co.	96, 108
Grant Gear Works	92
Grant Mfg. & Machine Co.	85
Gray Co., G. A.	43
Gray & Prior Machine Co.	84
Greaves-Klusman Tool Co.	98
Grey Mfg. Co., C. M.	89

	Page
Hall Planetary Thread Milling Machine Co.	74
Hamilton Machine Tool Co.	100
Harrington Son & Co., Edw.	82
Hart Mfg. Co., R. A.	108
Hartford Special Machinery Co.	120
Hawkridge Bros. Co.	87
Haynes Stellite Co.	3rd Cover
Heald Machine Co.	30, 31
Hendey Machine Co.	131
Henry & Wright Mfg. Co.	28
Hill, Clarke & Co., Chicago	113
Hilliard Clutch & Machinery Co.	84
Hjorth Lathe & Tool Co.	97
Hoefer Mfg. Co.	96
Hoggson & Pettis Mfg. Co.	106
Horsburgh & Scott Co.	93
Horton & Son Co., E.	107
Hunter Saw & Machine Co.	106
Hurlbut Rogers Machinery Co.	100
Hydraulic Press Mfg. Co.	80
Hyman & Sons, Joseph	117

	Page
Ideal Machinery Co.	114
Imperial Brass Mfg. Co.	88
Industrial Plants Corp.	120
Ingersoll Milling Machine Co.	18
Ingersoll-Rand Co.	78
International Machine Tool Co.	100

	Page
Jessop & Sons, Wm.	87
Johnson Bronze Co.	89
Johnson Gas Appliance Co.	88
Johnson Machine Co., Carlyle	57
Johnston Mfg. Co.	98
Jones & Lamson Machine Co.	12, 13, 64

	Page
Kearney & Trecker Corp.	51
Keller Mech. Engraving Co.	122
Kelly Co., R. A.	74
Kempsmith Mfg. Co.	123
Knight Machinery Co., W. B.	72

	Page
Lamberg & Co., A.	116
Lambert & Todd Mach. Co.	122
Landis Machine Co.	8
Landis Tool Co.	45
Langelier Mfg. Co.	50
Lapointe Co., J. N.	92
Lapointe Machine Tool Co.	112
Latrobe Tool Co.	110
LeBlond Machine Tool Co., R. K.	35
Leland-Gifford Co.	62
Lewis-Shepard Co.	84
Liberty Machine Tool Co.	34
Light Mfg. & Foundry Co.	89
Lincoln Machine Co.	122
Link-Belt Co.	125
Lodge & Shipley Machine Tool Co.	4, 5
Long & Allstatter Co.	58
Louisville Elect. Mfg. Co.	75
Lucas Machine Tool Co.	45
Lux Clock Mfg. Co.	123

	Page
Manufacturing Equipment & Engineering Co.	92
Marvin & Casler	110
McCrosky Tool Co.	99
McMullen Machinery Co.	117
Meachem Gear Corp.	91
Mehl Machine Tool & Die Co.	123
Meisel Press Mfg. Co.	90
Meisselbach-Catucci Mfg. Co.	93
Merrell Mfg. Co.	104
Metzler, Inc., Robert J.	119
Millholland Machine Co.	100
Minster Machine Co.	96
Mitts & Merrill	72
Modern Tool Co.	129
Moline Tool Co.	96
Mo trup Steel Products	87
Monarch Machine Tool Co.	100
Moore & White Co.	83
Morey & Co.	116
Morris Machine Tool Co.	96
Morse Chain Co.	135
Morse Twist Drill & Machine Co.	110
Morton Mfg. Co.	74
Mueller Machine Tool Co.	100
Munson, E. G.	123
Murchey Machine Tool Co.	3

	Page
Napier Saw Works	105
National Acme Co.	32
National Automatic Tool Co.	54
National Business Bourse	119
National Machinery Co.	72
National Tool Co.	112
National Twist Drill & Tool Co.	110
Nazel Engineering & Machine Wks.	103
Nell & Smith Electric Tool Co.	75
Nelson-Blanck Mfg. Co.	96
Newark Gear Cutting Machine Co.	74
Newcomb Spring Corp., The	92
New Jersey Machinery Exchange	118
New London Ship & Engine Co.	122
Newton Machine Tool Works	23
Nicholson & Co., W. H.	102
Nicholson File Co.	133
Niles & Co., F. H.	118
Niles-Bement-Pond Co. 2nd Cover, 112, 116	
Noble & Westbrook Mfg. Co.	89
Norma Co. of America	82
Northern Engineering Works	84
Norton Co.	71

	Page
Oakley Chemical Co.	101
Oilgear Co.	80
Oliver Instrument Co.	88
Osborne & Sexton Mchy. Co.	118

	Page
Pangborn Corporation	90
Pannier Bros. Stamp Co.	83
Parker Co., Charles	108
Pawling & Harnischfeger	72
Pease Co., C. F.	108
Philadelphia Gear Works	90
Poorman, J. E.	123
Positions Wanted	119
Potter & Johnston	20, 21
Potter Tool & Machine Works, S. A.	98
Prentiss & Co., Henry	115
Purinton & Smith	114

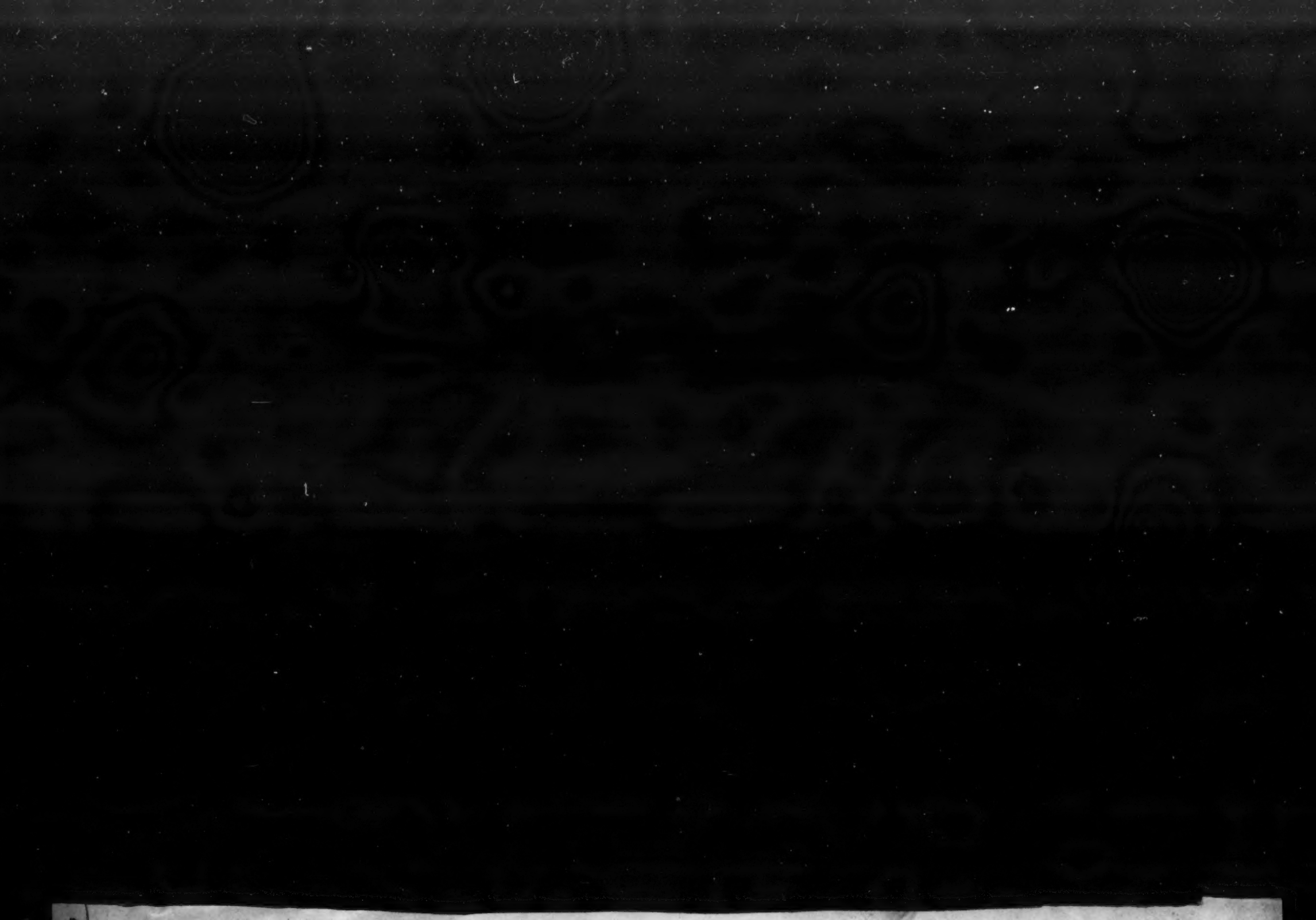
	Page
Queen City Machine Tool Co.	72

	Page
Randall & Stickney	104
Ransom Mfg. Co.	95
Reed-Prentice Co.	52
Reed Mfg. Co.	108
Reliance Electric & Engr. Co.	75
Rivett Lathe & Grinder Co.	100
Robbins Machine Works	123
Rockford Tool Co.	86
Rockwood Sprinkler Co.	64
Rogers & Hubbard Co.	86
Root Co., B. M.	122
Rowbottom Machine Co.	56
Royersford Fdry. & Mach. Co.	81
Russell Machine Co.	117
Ryerson, Joseph T. & Son	61

	Page
Safety Emery Wheel Co.	60
Sanford Mfg. Co., F. C.	95
Saunders Sons, D.	104
Savage Co., W. J.	105
Schatz Mfg. Co.	81
Schieron Co., Chas. A.	82
Searchlight Section	113
Sellers & Co., Wm.	97
Seneca Falls Mfg. Co.	53
Sexton Machine Co.	122
Seyferts Sons, Inc., L. P.	119
Shepard Elec. Crane & Hoist Co.	84
Shepherd Eng. Co.	122
Sherritt & Stoer Co.	118
Shore Instrument & Mfg. Co.	108
Shuster Co., F. B.	85
Sidney Machine Tool Co.	100
Silver Mfg. Co.	97
Simmons Machine Co.	115
Simmons Method Hob Co.	111
Simonds Mfg. Co., Pittsburgh	92
Simplex Tool Co.	120
Simplex Wire & Cable Co.	75
Sipp Machine Co.	96
S K F Industries	29
Skinner Chuck Co.	106
Smith & Mills Co.	72
Smith & Serrell	84
South Bend Lathe Works	100
Springfield Machine Tool Co.	33
Standard Elec. Tool Co.	75
Standard Engr. Works, Pawtucket	73
Standard Gauge Steel Co.	48
Standarn Machy Co.	114
Stark Tool Co.	100
Starrett Co., L. S.	68
Steel Products Eng. Co.	48
Steinle Turret Machine Co.	100
Sterling Grinding Wheel Co.	94
Sterling Specialty Co.	81
Stokvis & Sons, R. S.	117
Stoll Co., D. H.	103
Strand & Co., N. A.	94
Stroud, Arva	94
Sullivan Machinery Co.	80
Sun Co.	101

	Page
Taylor & Penn Co.	72
Terkelsen Mach. Co.	108
Texaf Co.	59
Thompson & Son Co., H. G.	106
Thomson Electric Welding Co.	88
Thomson Spot Welder Co.	88
Toledo Crane Co.	83
Toledo Machine & Tool Co.	103
Toomey Inc., Frank	114
Torrington Co.	100
Townsend Mfg. Co., H. P.	85
Treadwell Engineering Co.	105
Tucker, W. A. and C. P.	101, 105
Turner Machine Co.	97

	Page
Underwood Corp., H. B.	84
Union Drawn Steel Co.	86
Union Mfg. Co.	107
Union Twist Drill Co.	69
U. S. Electrical Tool Co.	75
U. S. Tool Co.	102
Universal Machine Co.	104

	Page
Vanadium-Alloys Steel Co.	87
Vandyck-Churchill Co.	106
Van Norman Machine Tool Co.	35
Victor Saw Works	106
Victor Tool Co.	109
Vitrified Wheel Co.	94
V & O Press Co.	102
Vulcan Crucible Steel Co.	86

	Page
Wade-American Tool Co.	98
Waltham Machine Works	60
Want Ads	119
Warner & Swasey Co.	57
Watson Stillman Co.	90
Wayne Machinery Co.	117
West Tire Setter Co.	103
Westinghouse Electric & Mfg. Co.	77
Wheel Trueing Tool Co.	94
Whipp Machine Tool Co.	72
Whitcomb Blaisdell Mch. Tool Co.	52
White & Bagley Co.	101
Whitman & Barnes Mfg. Co.	110
Whitney & Son, Baxter D.	95
Whitney Mfg. Co.	65
Whiton Machine Co., D. E.	107
Wickes Bros.	55
Williams & Co., J. H.	89
Wilmarth & Morman Co.	95
Winterer, H. L.	118
Woodward & Powell Planer Co.	72
Worcester Pressed Steel Co.	86